UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 677

Contribution from the Bureau of Soils
MILTON WHITNEY, Chief

Washington, D. C. PROFESSIONAL PAPER October 24, 1918

SOILS OF SOUTHERN NEW JERSEY AND THEIR USES

By

J. A. BONSTEEL, Scientist in the Soil Survey

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CHARACTER OF THE REGION.

LOCATION.

The southern part of the State of New Jersey, lying south of the line of the Pennsylvania Railroad between Trenton and New Brunswick and comprising about 4,400 square miles, is a compact area within which the climatic conditions, the accessibility to great markets, the means of transportation to those markets, and the skill and industry of the agricultural population are sufficiently uniform to afford an unusual opportunity for the study of the influence of the character of the soil upon the production of farm crops.

This region lies between the Atlantic Ocean and the Delaware River and Bay. Its southern extremity is in latitude 38° 55′ N. and its northern border extends to latitude 40° 30′ N. It includes all of the counties of Monmouth, Ocean, Burlington, Camden, Atlantic, Gloucester, Salem, Cumberland, and Cape May, and the southeastern portions of Middlesex and Mercer.

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The total land area of this region is 2,833,840 acres. The United State Census for 1910 shows that 1,311,244 acres are included in farms and that 880,755 acres are classed as improved farm lands.[1]

CLIMATE.

The climatic conditions which prevail in this region are summarized by the Weather Bureau in "Summary of Climatological Data, Section 99—The Southern Interior and Sea Coast of New Jersey." This summary shows that precipitation during the growing season is adequate for the production of normal crops and that the interval between killing frosts in spring and fall is normally sufficient to mature all of the general farm crops and the majority of the vegetables and fruits. The climatological tables also indicate that the conditions prevailing over the region are so uniform that no locality or section is especially favored over others. The more important climatic facts are summarized in the chart, figure 1. It would appear from this chart that, so far as climatic conditions are concerned, agriculture might be uniformly developed over the entire region.

MARKETS.

It will be seen from the chart, figure 2, that the entire region is favorably located with respect to the metropolitan district of New York, which, in 1910, possessed a total population of 6,630,559 and to the metropolitan district of Philadelphia, which possessed a population of 2,015,560 at that time. The extreme distance from the most remote point in southern New Jersey to New York City is a little less than 130 miles, and it is less than 75 miles to Philadelphia. Railroad communication is unusually well developed and a good system of highways tends to place all portions of the region in easy communication with the great market centers.

AGRICULTURAL POPULATION.

Southern New Jersey was originally settled about 275 years ago by agricultural peoples from the various countries of northern Europe. During the intervening period agriculture has been developed along lines suited to the broader local needs and to meet the specific requirements of the separate localities. Owing to the existence of great near-by markets agriculture has experienced a notable degree of specialization to meet market demands, and experience has generally developed the use to which the different soils of the region may best be put under the existing conditions of demand for farm products.

[1] U. S. Census, 1910, vol. V, Agriculture, p. 740.

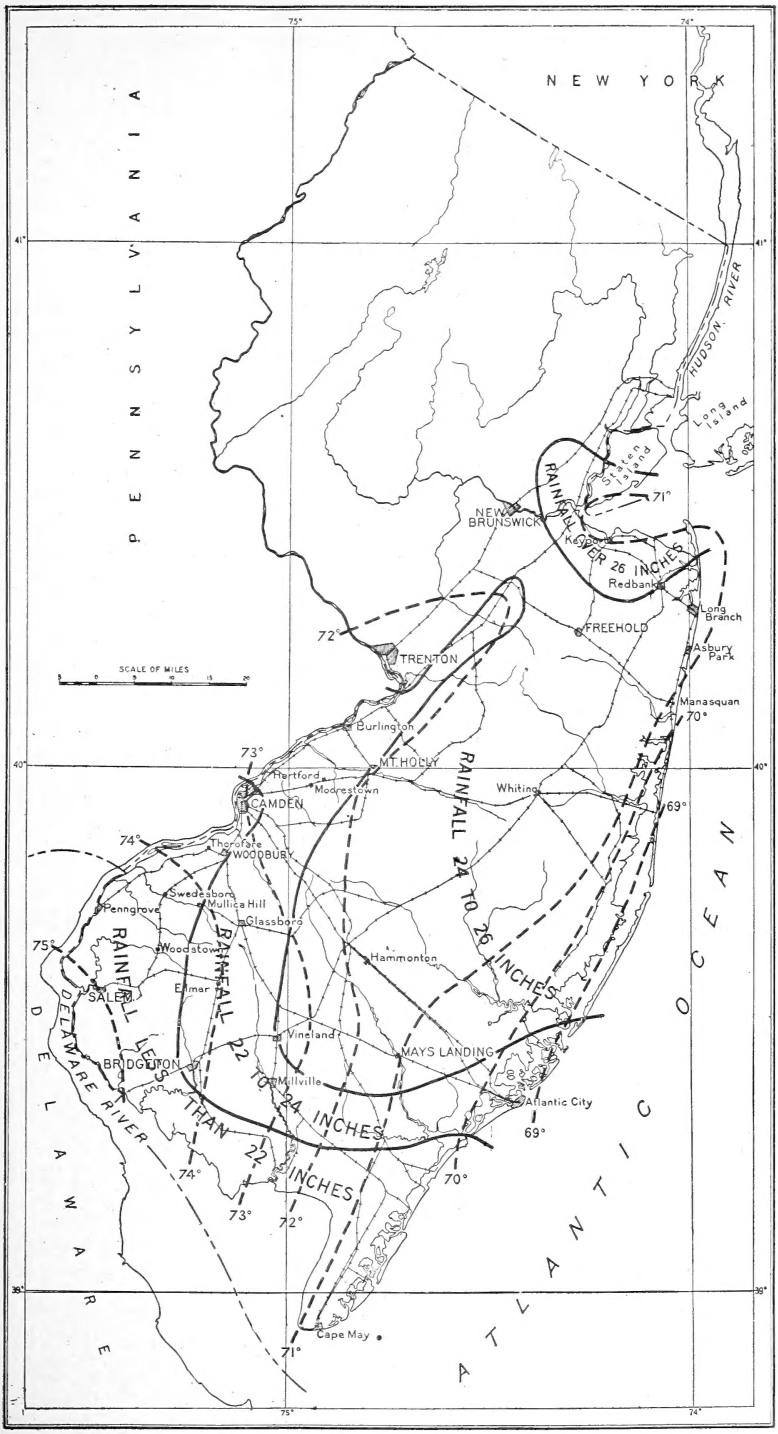


FIG. 1.—Rainfall zones and isotherms, summer season.

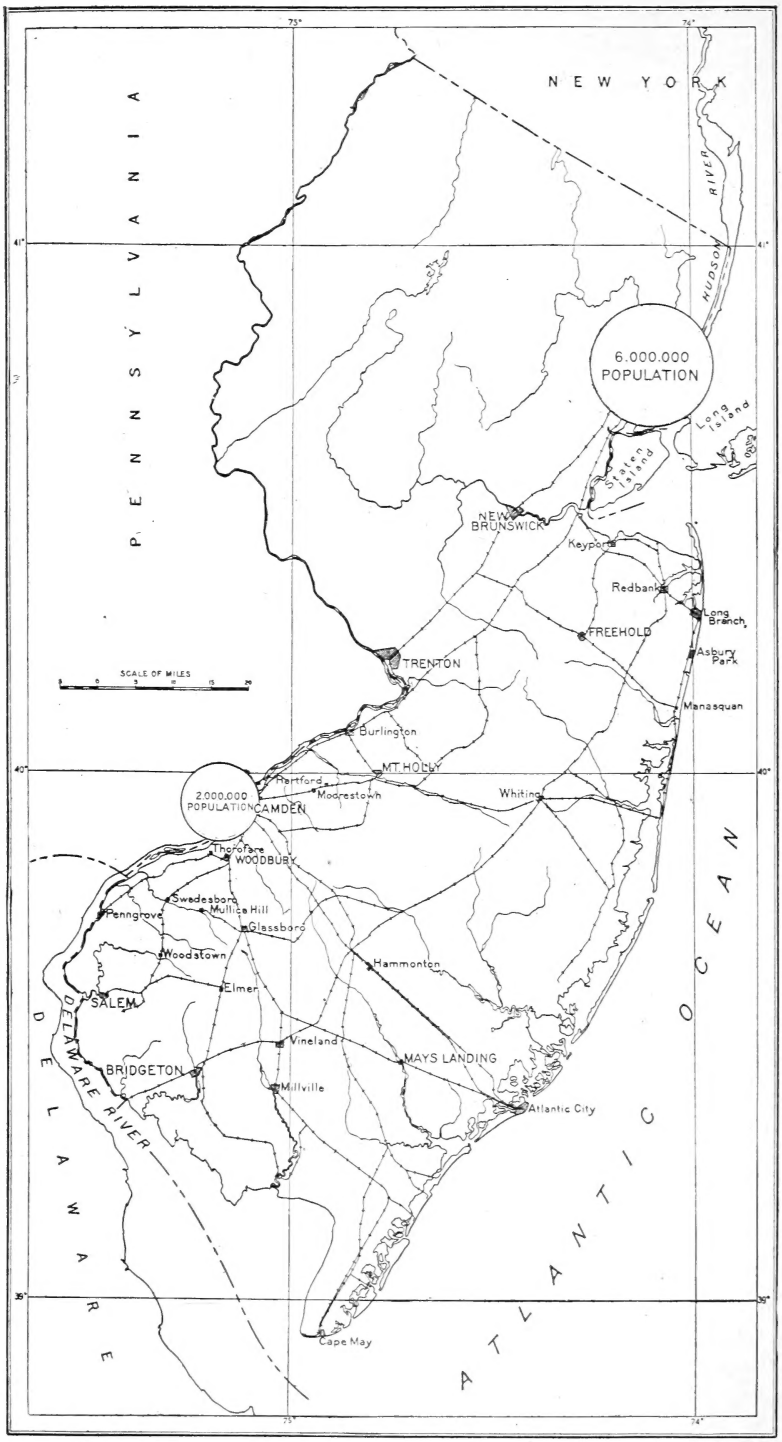


FIG. 2.—Chart showing metropolitan districts, principal towns, and connecting railroads.

PHYSICAL FEATURES.

The general surface features of southern New Jersey may be described as those of a gently sloping plain of low relief which is marked by a ridge extending from the Atlantic coast line near Sandy Hook to the vicinity of Delaware Bay, near Bridgeton, N. J. (See fig. 3, p. 6.) From this ridge the land surface slopes unequally toward the southeast and toward the northwest. The former slope frequently is at the rate of less than 5 feet to the mile, but the latter usually is greater and frequently is accomplished by steeper slopes intervening between areas which are gently sloping or nearly level. It is estimated by the New Jersey Geological Survey that less than 15 square miles of the section rise above an altitude of 200 feet and that not more than 120 square miles rise above 100 feet in elevation.

One of the marked features of the region is the presence along the shores of the Delaware River and Bay of a lowland or terrace of varying width which rises gently to an elevation of 40 to 50 feet. In places this lowland is not more than 2 or 3 miles broad, though in others it expands to a width of 10 or 12 miles. It is usually bounded, inland, by steeper slopes, rising to the watershed or to more elevated areas of gentle slope.

A very large proportion of the entire area is nearly level or but gently sloping, and it is only over restricted areas that the surface slope is too great or that the land is too broken to allow tillage.

SOILS.

Practically all of the soils of the region have been derived from unconsolidated sands, loams, clays, and marls. Only in scattered localities has there been any hardening of the material into cemented masses of sand and gravel, or, as they are locally known, "ironstone." Some gravel occurs throughout the region, either in beds underlying the soils or scattered in varying amount through the soil and subsoil.

There is a sufficient variety in the soil-forming material to give rise to a number of distinct soil types and series. These have been mapped and described in the soil surveys which have been made in the region, and a detailed account can be found in the different reports.[1] Therefore only a brief summary of the different soil series will be given.

Lakewood series.—The surface soils of the types in the Lakewood series are white in color and the subsoils orange yellow. The series occupies rolling to nearly level uplands in the Atlantic slope and

[1] Field Operations of the Bureau of Soils, 1901, Soil Survey of the Salem Area, N. J.; idem, 1902, Soil Survey of the Trenton Area, N. J.; idem, 1913, Soil Survey of the Freehold Area, N. J.; and idem, 1915, Soil Survey of the Camden Area, N. J.

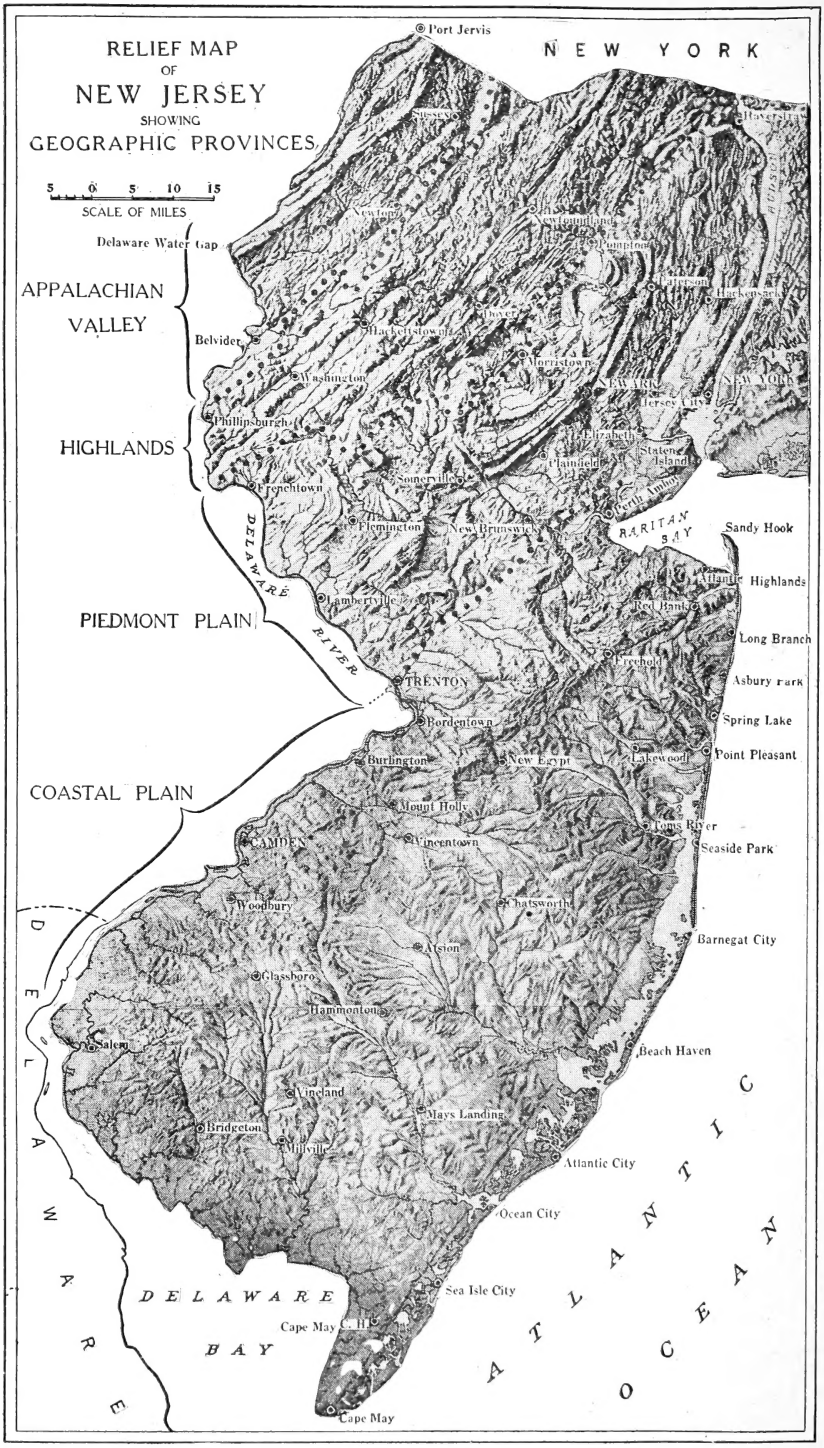


FIG. 3.—Geographic Provinces of New Jersey.

drainage is in many places excessive. The Lakewood sand, fine sand, and gravelly sandy loam have been mapped. The soils of this series are cultivated to only a small extent.

Sassafras series.—The surface soils of the Sassafras series are distinguished by a brown or yellowish-brown color and the subsoils are a deep yellow or reddish yellow. In many places a distinct bed of gravel or of coarse sand and gravel underlies these soils at a depth ranging from 2½ to 5 feet below the surface. The series is found in all parts of southern New Jersey, in somewhat scattered occurrences in the Atlantic slope, but especially well developed along the Delaware River and in the plain which extends between Trenton and New Brunswick. Most of the types in this series are well drained. The types of the series include the Sassafras coarse sand, sand, loamy sand, fine sand, gravelly sandy loam, coarse sandy loam, sandy loam, fine sandy loam, and loam.

Collington series.—The surface soils of the Collington series usually have a rather dark brown color and the subsoils are of a yellowish to greenish brown. The series is marked by the presence of glauconite or greensand in the subsoils. It occurs chiefly along a narrow belt extending southwestward from the vicinity of Atlantic Highlands nearly to Salem. This belt varies from 1 or 2 to nearly 15 miles in width. It is not entirely occupied by soils of the Collington series. The surface features of the soils of this series are varied, ranging from gently sloping or nearly level to distinctly hilly and broken. Probably 60 per cent of the area of these soils is sufficiently level to meet the requirements of cultivation. Drainage is well established over the greater part of the soils of the series, being defective only in the case of the heavier soils. The series includes the Collington sand, loamy sand, sandy loam, fine sandy loam, gravelly loam, loam, clay loam, and clay. The sandy loam and fine sandy loam are most extensive and of greatest importance agriculturally.

Colts Neck series.—The soils of the Colts Neck series are characterized by the brownish-red to dark-red color of the surface soils and by the bright to deep red color of the subsoils. They occur typically in the hilly to undulating areas of the marl belt and are well drained and easily tilled where the surface slope is not too great. The series includes the Colts Neck gravelly sand, loamy sand, sandy loam, fine sandy loam, and loam.

Norfolk series.—The soils of this series are marked by the grayish color of the surface soils and by the yellow color and friable structure of the subsoils. Only the Norfolk fine sand has thus far been encountered in southern New Jersey. It is usually hilly to rolling, well drained, and for the most part forested. Only the more level areas are occupied by farms.

Keyport series.—The surface soils of the Keyport series are grayish brown to brown in color and the subsoils are yellow and friable to mottled drab and yellow and somewhat plastic in the deeper subsoil. The surface soils are usually well drained, but artificial underdrainage is frequently needed on the heavier types. The soils of this series are of limited extent, occurring chiefly around Raritan Bay. The Keyport sandy loam, fine sandy loam, loam, and clay loam have been mapped.

Shrewsbury series.—The surface soils of the Shrewsbury series are gray to grayish brown in color and the subsoils are mottled gray, yellow, drab, and green. The series is chiefly found in low areas and slight depressions, and the deeper subsoils usually contain an appreciable quantity of greensand. The Shrewsbury sandy loam, fine sandy loam, loam, and silt loam have been mapped.

Keansburg series.—The surface soils of the types in the Keansburg series are dark gray to black and well supplied with organic matter. The subsoils are mottled gray, drab, and yellow and marked with reddish iron stains. The presence of greensand can sometimes be distinguished. The soils of this series occupy depressed, poorly drained areas in the marl belt and require artificial drainage to become of agricultural value. The Keansburg sand, sandy loam, fine sandy loam, and loam have been mapped.

Elkton series.—The surface soils of the Elkton series are ashy gray to brownish gray in color, and the subsoils are pale yellow, becoming mottled yellow and gray at lower depths. They are usually associated with soils of the Sassafras series, occupying flat or depressed areas where drainage is imperfect. Only the Elkton loam has been mapped.

Portsmouth series.—The surface soils of the Portsmouth series are dark gray to black in color and well supplied with organic matter. The subsoils are pale gray to nearly white, sometimes faintly mottled with yellow. These soils occupy depressed and poorly drained areas, chiefly along streamways and around the headwaters of swampy streams. They are chiefly forested and require artificial drainage before they are available for agricultural use. The Portsmouth sandy loam and loam have been mapped in southern New Jersey.

Hyde series.—The soils of the Hyde series are characterized by their naturally poor drainage and by the black color of both soil and subsoil to a depth of 3 feet or more. They are high in organic matter. They occupy low-lying and depressed areas along streams, around stream heads, and in swampy upland positions. They must be artificially drained before they can be cropped. Only the Hyde loamy sand has been mapped in southern New Jersey.

Freneau series.—The surface soils of the types included in the Freneau series are dark brown or mottled brown and reddish brown

in color. The subsoils are mottled reddish brown, green, and drab. The Freneau loam is the only type of the series mapped in southern New Jersey. It occupies stream bottoms within the marl belt, and is naturally poorly drained. It is chiefly forested or used for pasturage, although small areas have been drained and cultivated.

Tidal marsh.—Considerable areas of Tidal marsh occur around the coast line of southern New Jersey. Some areas have been diked and drained and are used for pasture, the cutting of hay, and, to a small extent, the growing of corn.

Meadow.—Immediately inland from the Tidal marsh areas the streams of southern New Jersey are frequently bordered by nearly level, marshy tracts which are subject to occasional inundation by stream freshets and to the addition of new soil material. These flood-plain areas have been mapped as Meadow. They are either forested or used for grazing.

Coastal beach.—Between the tidal marshes and the ocean or bay there are sandy accumulations in the form of barrier beaches which have been mapped as Coastal beach. Owing to the sandy nature and uneven surface, together with the shifting of the surface materials under wind action, these areas have no agricultural value.

GENERAL VIEW OF THE SOIL-CROP RELATIONS OF SOUTHERN NEW JERSEY.

There are three rather distinct subdivisions of the region into a forested area, occurring chiefly within the Atlantic slope, a tide marsh area, which intervenes between the barrier beaches along the Atlantic Ocean and the main land and which also fringes the lower reaches of the Delaware River and Bay, and a long, narrow, curved belt of dominantly agricultural lands, which stretches from the waters of Raritan Bay southwestward to the Delaware River and thence borders that river and Delaware Bay to the mouth of the Maurice River.

These three regions of differing occupation correspond closely with the major soil differences of the region. The forested area is clearly related to the prevailing areas of the white sandy soils of the Lakewood series (fig. 4). These soils are normally too porous to retain sufficient moisture for the production of either staple or special crops. Experience has shown that the territory had best remain in timber. The tide marsh areas (fig. 5), on the other hand, are too wet under normal conditions to permit of crop production and it is only in restricted areas, where diking and drainage have been installed, that these areas are used to produce crops of any kind. Where they have been reclaimed, crops of hay (fig. 6) and corn are

grown, although a considerable portion of such areas is only used for grazing. These subdivisions are excluded from present agricultural

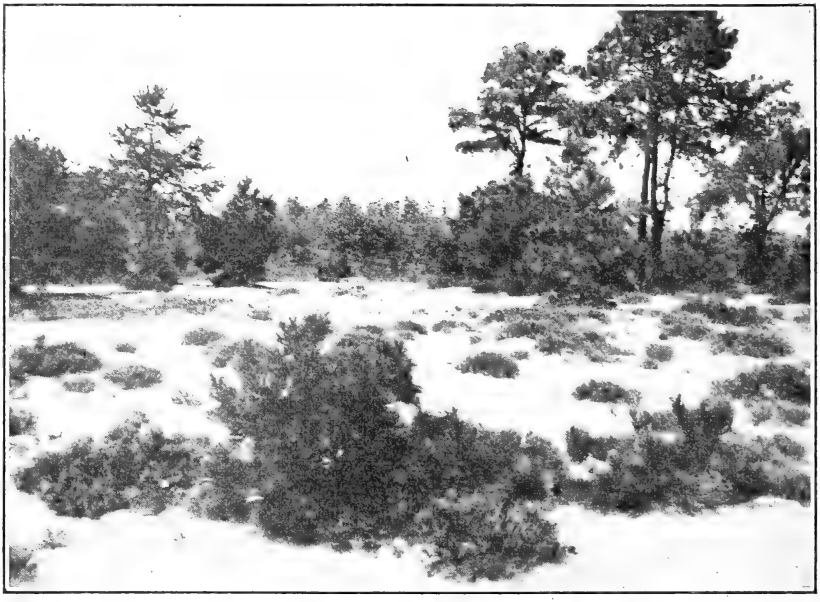


FIG. 4.—Pitch pine and scrub oak on the Lakewood sand.

utilization by the two extremes of soil drainage. One is prevailingly too dry, the other too wet.

FIG. 5.—Unreclaimed Tide marsh along Delaware River.

The third division of the region includes all of those soils of intermediate drainage conditions which may be occupied more or less

intensively for some form of crop production. Within that division agriculture has been developed to a high degree of specialization, with a certain amount of selection of particular soil conditions for the growing of specific crops. Probably the two most important natural factors determining the class of occupation of the land in this region are the topographic features of land slope and the natural drainage conditions of the upland soil types.

Since the surface slope largely controls the mechanical efficiency of farming operations, rough, sloping land may not be economically occupied for the purposes even of staple crop production. Yet where slopes are not too steep or the surface too broken the excellent facilities for both air and soil drainage frequently render such

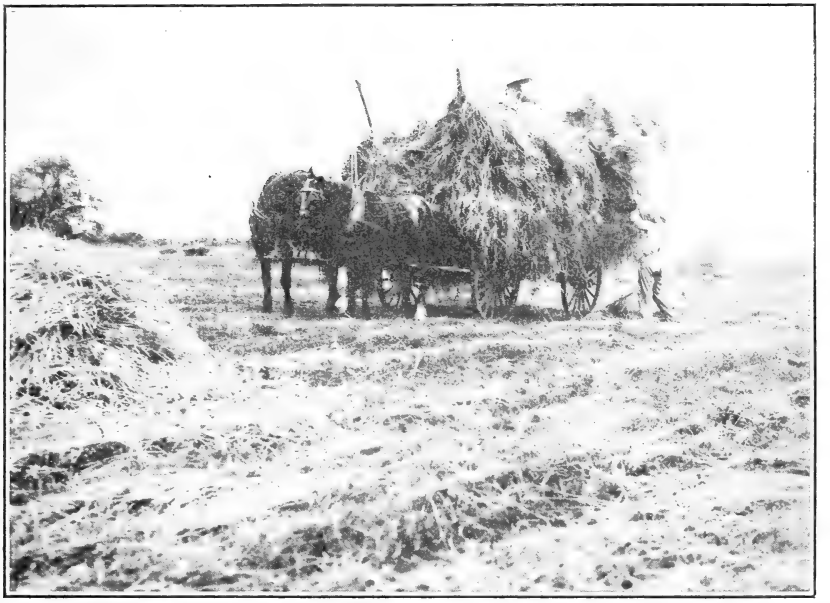


FIG. 6.—Harvesting timothy hay on reclaimed Tide marsh, near Woodbury, N. J.

situations desirable for certain forms of orcharding. In eastern Monmouth County such areas occur with soil conditions otherwise favorable to agriculture. Some of the finest orchards in the region are located on these rolling to decidedly hilly lands. In other cases where the land is too broken or danger from destructive erosion is too great, the land is either in forest or occupied as pastures.

A second class of lands within the dominant agricultural region which has escaped the intensive occupation common to the region comprises such soils as from their position or texture are commonly waterlogged.

Along many of the minor drainage ways the sluggish stream course is bordered on one or both sides by lands subject to periodical over-

flow. Such areas are quite commonly grown up to water-loving trees, shrubs, and vines, and their only present use is to furnish scanty pasturage. In some cases the broader bottoms have been cleared, and excellent pasturage is found on the moist bottom soils. Some of the larger areas have been ditched and even tile drained and are used for growing forage crops, potatoes, and cabbage. Small areas of this class of land, commonly mapped on the soil maps as Meadow, are highly esteemed, if not present in too great area, because of the pasturage afforded to work stock used on the intensively farmed upland or to small herds of dairy cattle.

There are also considerable areas of soils which in their natural condition require artificial drainage to become suited to the growing of the staple and special crops common to the region. Such soils in southern New Jersey fall chiefly into the Freneau, Hyde, Portsmouth, and Elkton series. The greater part of the total area of these soils in the section is either forested or used for pasturage or for the cutting of hay.

Usually soils of these classes are first cleared to afford added areas of pasture and, later, to come under cultivation for growing the forage crops required on the particular farm. Sometimes small bodies of any of these soils, which extend into larger areas of upland soils, may be drained more completely either by open ditches or by tile, and utilized along with the remainder of the individual field for the growing of the staple or special crops. In such cases the common crops of the section are extended over such small areas without any particular reference to natural soil boundaries.

The soils of the Keansburg, Shrewsbury, and Keyport series are rather better drained than the preceding group, but usually require some attention to artificial drainage before they are available for extensive agricultural use. Even in their natural state they may be used to produce grass and hay, and a considerable proportion of their total area will support good crops of corn. For more intensive forms of farming, however, they frequently require ditching and tiling. When this is done they give good returns with such crops as potatoes and cabbage. The heavier soils of these series are commonly used for forage crops, while the more sandy types are somewhat preferred for the growing of the later and heavier truck crops.

The general reconnoissance of the entire territory of southern New Jersey soon showed that the chief agricultural development, and especially the extension of the more intensive forms of cropping, had occurred upon soils of the Sassafras, Collington, and Colts Neck series. With these soils must also be included the small areas of soils of the Norfolk series to be found in the section. Not only are the soils of these series the unquestioned basis for the greater part of the agriculture of the region, but even scattered and restricted areas

of these types when distributed among broader areas of less desirable types have been sought out and cleared. Such areas are found in many of the smaller clearings which are interspersed through the forested area, and they constitute an excellent illustration of the influence exerted by the character of the soil upon the agricultural occupation.

It is not by chance that the intensive forms of truck and fruit growing and the more extensive forms of staple cropping have been developed upon these particular soils. Years of experience have taught that soils of these groups constitute the safe foundation for agriculture and that they excel all other soils of the region for staple and special crop production.

A comparison of the map showing the general distribution of soil groups with that showing the tilled and forested land in southern New Jersey will at once demonstrate this selective use of the soils of the region.

The specialization of agricultural development within southern New Jersey has not rested merely with the occupation of certain general soil groups for farming purposes while others have remained uncultivated.

Among these chosen agricultural soils, experience has shown that certain soils are most successfully used for certain crops and successions of crops, and there has arisen a segregation of cropping practices which follows to a rather marked degree the specific characteristics of soils.

One of the best examples of this selection of soils for specific uses over a considerable territory may be observed in Salem County, N. J., and in adjacent portions of Cumberland County.

To the north and east of Salem and extending nearly to Elmer, quite to Shiloh, and almost to Bridgeton, N. J., is a large area of heavy loam soil, locally termed a "clay" in some cases. This large area of the Sassafras loam has long been the location of an excellent system of general farming in which corn, wheat, and hay have occupied the most prominent positions. In connection with these crops dairying has been practiced. Yields of each of these crops decidedly in excess of the average yields of the State or of the section are obtained. Until recent years this form of agriculture was almost the only one followed. The demand for certain special crops has lately brought about some changes in the cropping system, introducing potato growing and the production of tomatoes for the canning factory. Both of these special crops are well suited to the land in question. Few attempts are made to produce early market tomatoes, and in the case of potatoes dependence is chiefly placed upon the size of the crop rather than upon early maturity. Thus, even with increased specialization in cropping, careful attention is paid to the natural capabilities of the soil of this section.

This large area of heavy loam soil is sharply contrasted with areas of more sandy land to the north and east, on which the type of agriculture adopted is in no less marked contrast. Upon the sandy soils early market tomatoes, sweet potatoes, asparagus, corn, and clover predominate. Upon the heavy loam corn, wheat, mixed grasses, and Irish potatoes occupy nearly all of the acreage. Yet the climatic surroundings are essentially the same, and so also is the accessibility to market of different portions of the two areas.

Thus, even among the most desirable soils of southern New Jersey, experience has proved that careful attention must be paid to the inherent properties of the soils of any locality in order that the most profitable kind of cropping and the best adjusted system of agriculture may survive upon them.

These observations markedly illustrate the fact that the character of the soil, other things being equal, determines not only the character of the crops which may be grown successfully and the class of farming which will result but also the fact that extreme differences in soil condition will determine the major fact as to whether soils may be occupied for agriculture at all.[1]

DETAILED SOIL AND CROP MAPS.

In order that an exact estimation might be made of the actual uses to which soils are put in southern New Jersey, several very detailed soil and crop surveys were made of selected areas within the territory.

One survey was made immediately south of Freehold, in a highly specialized potato-growing section. Another was made in the vicinity of Hartford, another around Thorofare, and a fourth immediately to the north of Swedesboro. All of these areas are located within an intensively farmed belt, and the four areas include within their limits some portions of all of the more important agricultural soils of the section. They are all well supplied with transportation facilities and all are readily accessible to markets capable of absorbing considerable quantities of all the products which may be grown under the existing climatic conditions.

It is safe to say, therefore, that existing differences in cropping are measurably capable of correlation with the differences in soil characteristics which are found to exist.

[1] More detailed statements with respect to these major matters of the distinctive uses of soils for the growing of particular crops may be found in the various reports upon the areas of which soil surveys have already been made in southern New Jersey, a list of which is given in a footnote on page 5. A similar correlation of soil and crop facts has been made and published for a portion of the territory under discussion in Farmers' Bulletin 472, of the United States Department of Agriculture, "Systems of Farming in Central New Jersey," by Geo. A. Billings and J. C. Beavers.

Each of the four areas constitutes a portion of a locality which has been developed to a marked degree for special agricultural production. It is in such areas that the closest adjustments of farm practices to natural conditions may naturally be looked for. It may reasonably be held that the existing adaptations of crop to soil have resulted from the observations of skilled farmers acting through a considerable period of years. In all four areas the sums invested in each year's operations represent a risk which the individual farmer desires to minimize through the adoption of every proved device of agricultural art which will add certainty to his prospects of profit.

In all cases the field maps were platted upon a scale of 6 inches to the mile through the ordinary methods of plane-table survey. Boundaries of fields and of other forms of occupation are shown and the kind of crop occupying each area of land at the time of the survey is indicated. This cultural map is combined with a detailed soil map so that the relationship of crops to soil may be read directly from the single map.

In order that the details of soil occupation might be determined, the completed maps were measured and the acreage of each form of occupation of each soil type was computed.

The accuracy of all of the maps is controlled by adjustment to the topographic maps of the region, executed by the New Jersey Geological Survey in cooperation with the United States Geological Survey. Upon the scale adopted for this special soil and crop mapping it is estimated that accuracy may be attained down to the limit of one-fourth of an acre.

The total area of each map and of each soil type was measured, and the total area of each crop upon each soil type was also measured, independently. It was found that interplanting and duplication of cropping gave rise to an excess of land occupation over total land area in some instances. In all cases the percentages of land occupation are figured on the basis of the total land occupation, in order to give each soil type its full weight in the production of each crop.

Table I shows the relationship between total land areas and total occupation by crops and otherwise for each area mapped.

TABLE I.—*Total area, area occupied by crops, and area of waste land in each of the four soil-crop survey areas.*

Area.	Total area mapped.	Total area of intensive occupation.	Total area rough and swampy lands.
	Acres.	*Acres.*	*Acres.*
Freehold	2,515.8	2,507.1	
Hartford	2,259.1	2,078.6	216.6
Thorofare	1,476.3	1,358.5	123.5
Swedesboro	2,597.3	2,490.9	144.4

SOIL AND CROP SURVEY OF THE FREEHOLD AREA.

The area immediately south of Freehold was studied and mapped during August, 1914. It is located upon the Amboy Division of the Pennsylvania Railroad and upon the Central Railroad of New Jersey about 40 miles from New York City, 30 miles from Trenton, N. J., and 70 miles from Philadelphia, Pa. Its location with respect to both markets and transportation, therefore, is favorable.

The area mapped is located just south of the ridge which divides the Atlantic drainage from that of the Delaware River. The highest elevation within the area of the map—190 feet above tide level—occurs within the limits of Freehold. There is a gentle slope to the south throughout the area and an altitude of 140 feet is reached along the southern border of the map.

The location of this detailed map is indicated on Plate A, page 16. The topography and soil conditions of the general region are shown on the large map of the Freehold area published to accompany the regular soil survey of that section.[1]

SOILS.

Freehold is located within what is known as the "marl belt" of southern New Jersey. As a result, the underlying materials within the limits of the map consist chiefly of glauconite, or greensand, containing variable proportions of clay and quartz sand. To a small extent the area is also underlain by the rusty, red, sticky sand of the Redbank formation, which contains plates and angular fragments of iron crust.

Over the greater part of the area this basal material is covered to varying depths by later deposits, and the deeper layers are chiefly exposed along the margins of streams upon rather steeply sloping areas.

The underlying marl beds have influenced the surface layers from which the dominant soils are derived to some degree and the deeper subsoils sometimes show unmistakable evidences of admixture of marl.

Sassafras loam.—The surface soil of the Sassafras loam, to an average depth of 10 or 12 inches, is a mellow, brown to dark-brown silty loam. It is underlain by a yellowish-brown to brown, heavy silty loam, which is rather more compact than the surface soil. The total depth of surface soil and subsoil in the Freehold area ranges from 1 or 2 feet along the slopes to the streams to 5 or 6 feet over the greater part of the upland.

In the Freehold area, as elsewhere in southern New Jersey, the type occupies nearly level to gently sloping uplands, and natural drainage is well established over the greater part of its surface.

[1] Field Operations of the Bureau of Soils, 1913, p. 95.

Bulletin 677, U. S. Department of Agriculture.

U. S. DEPT. OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT IN CHARGE SOIL SURVEY

GENERALIZED SOIL MAP

PLATE-A

SOUTHERN NEW JERSEY

LEGEND

Sassafras Series
- Fine sandy loam
- Collington and Colts Neck series
- Coarse sandy loam, Gravelly sandy loam, Sandy loam
- Norfolk series
- Coarse sand and loamy sand, fine sand
- Lakewood series
- Tide marsh

NOTE. Location of detailed surveys indicated thus —

75° 74° 40° 39°

PENN.

DELAWARE RIVER

DELAWARE BAY

ATLANTIC OCEAN

Keyport
Redbank
Long Branch
FREEHOLD
Asbury Park
TRENTON
Manasquan
Burlington
MT. HOLLY
Hartford
Moorestown
Whiting
CAMDEN
Thorofare
WOODBURY
Swedesboro
Mullica Hill
Pennsgrove
Glassboro
Woodstown
Hammonton
SALEM
Elmer
Vineland
MAYS LANDING
BRIDGETON
Millville
Atlantic City
Cape May

10 0 10 20 30 Miles

Soil areas by J. A. Bonsteel - 1915

BACHRACH & KESSLER CO. PHILA.

Bulletin 677, U. S. Department of Agriculture

This soil is representative of considerable tracts of land mapped as the Sassafras loam in the detailed surveys of the Camden, Freehold, Trenton, and Salem areas. It contains a slightly greater amount of greensand or glauconite in the deeper portions of the subsoil than is common, but in all other respects is typical.

It is recognized as a strong, productive agricultural soil best suited to the growing of general farm crops and of Irish potatoes. Practically every acre of the type is cleared and occupied for agricultural purposes both in the Freehold area and elsewhere in southern New Jersey.

Sassafras sandy loam.—The surface soil of the Sassafras sandy loam to an average depth of 8 to 10 inches consists of a light yellowish brown to brown sandy loam. It is somewhat heavy and coherent where it is associated with the Sassafras loam in the vicinity of Freehold. The subsoil is a yellow or yellowish-brown heavy sandy loam, which grades at a depth of about 30 inches into a more porous loamy sand.

The type is chiefly found on gentle upland slopes in the vicinity of Freehold, and the greater part of its area is well drained.

Colts Neck loam.—The surface soil of the Colts Neck loam, to an average depth of 7 or 8 inches, is a distinctly red or dark-red loam. The subsoil, to a depth of 30 inches, is a sticky, coherent, red loam. Usually below 30 inches the subsoil is more porous and the color a rusty red. In the vicinity of Freehold broken fragments of iron-cemented sand are found in the subsoil.

The surface of the type within the limits of the detailed soil and crop map made near Freehold is nearly level to gently sloping and the type is well drained. It is found chiefly along the gentle slopes from the upland to the streamways which drain the area. It only occupies a few narrow areas, forming portions of fields, and it is consequently tilled to the same crops and in the same rotations as the more extensive Sassafras loam, with which it is associated.

It is commonly used for the growing of corn, wheat, and hay. Irish potatoes are also grown, although the staining of the tubers, through the adhesion of red particles of soil slightly decreases their market value.

Colts Neck sandy loam.—The surface soil of the Colts Neck sandy loam varies from a bright-red to a dark-red sandy loam. The subsoil is a distinctly red, light sandy loam which grades downward into a somewhat more coherent sandy loam or sandy clay.

The type is of small extent, occurring near Freehold, where it occupies long, narrow, sloping strips along streamways. The surface is decidedly sloping, and the narrow strips of the type are not tilled differently from other soils with which they are associated.

Collington loam.—The surface soil of the Collington loam, to a depth of nearly 8 inches, consists of a brown loam, generally having a slight olive green tinge. The typical subsoil is a greenish-yellow loam, which in some cases is rather heavy and coherent. A considerable amount of greensand or glauconite is found in both surface soil and subsoil, particularly in the latter. The type is derived through the weathering of the underlying marl beds.

The surface is generally level and the natural drainage has become well established. Only small areas of the type are found in the immediate vicinity of Freehold and no distinctive cropping system has been developed for this soil.

Collington clay loam.—The surface soil of the Collington clay loam is a dark-brown to almost black loam having a depth varying from 3 to 6 inches. The immediate subsoil is a dark-brown to dark-green compact clay loam or clay. The deeper subsoil is somewhat more granular, and grades into the greensand marl from which the type is derived. It occurs only in small areas where marl beds are exposed at the surface.

The surface of this soil type is level or gently sloping. Drainage is fairly well established. Owing to its small extent, both near Freehold and elsewhere in southern New Jersey, no distinctive cropping system has been developed for it, although it is commonly recognized as being better suited for the production of grass and grain than for any other crops.

Collington sandy loam.—The surface soil of the Collington sandy loam, to an average depth of about 9 inches, is a light-brown to brown sandy loam, frequently showing a distinct greenish tinge. The immediate subsoil is a greenish-yellow sandy loam which becomes heavier and more coherent with depth. At about 30 inches it grades into a green loam or sandy clay, representing the greensand marl from which the type is derived.

The type occurs only to a limited extent near Freehold along sloping stream banks and it is not distinctively farmed.

Freneau loam.—Narrow stretches of somewhat poorly drained bottom land along the shallow stream courses within the area were mapped as the Freneau loam. In many cases, near Freehold, open ditches have been dug through this type and drainage has been sufficiently established to permit of crop production. The greater part of the type is used for pasture or the cutting of hay. The surface soil varies from place to place, but the subsoil consists rather uniformly of unweathered greensand marl, dark green in color and decidedly sticky and wet.

The Sassafras loam occupies 87.6 per cent of the total area surveyed, and all other types mapped are not only subordinate in extent

but also in importance. This type practically fixes the form of agriculture and the crop usages of the area represented.

The absolute and relative extent of the different soils mapped in the Freehold area is given in Table II.

TABLE II.—*Extent of different soil types, Freehold area.*

Soil type.	Area occupied.	Proportion of total occupied area.	Soil type.	Area occupied.	Proportion of total occupied area.
	Acres.	*Per cent.*		*Acres.*	*Per cent.*
Sassafras loam	2,098.8	83.7	Collington clay loam	15.3	0.6
Sassafras sandy loam	90.8	3.6	Collington sandy loam	14.1	.6
Colts Neck loam	68.2	2.7	Freneau loam	111.8	4.5
Colts Neck sandy loam	65.7	2.6			
Collington loam	42.4	1.7		2,507.1	

These soil types comprise the upland farming area and aggregate 2,507.1 acres of land occupied either for the production of crops, as farm woodlot, or for the necessary sites of farm homesteads and farm lanes.

USES OF SOILS.

The interpretation of the agricultural uses of the soils of this area is based upon:

(1) The total acreage of each crop as it stood in August, 1914.

(2) The percentage relationship of each crop area to the total area of all farm crops as mapped.

(3) The classification of all crops recorded into general farm crops, including lima beans; truck crops, including Irish potatoes; fruit crops, including all orchard, berry, and nursery crops, and the supplementary areas of land not used for the production of any annual crop, but occupied by gardens and grounds, forested areas, and land not in crops for various reasons.

This classification gives an opportunity for the comparison of the crop uses of each type with the standard as established for the area by the percentages given for "all soils." For example, it will be seen that the percentage of the total area of the Sassafras loam which is given to potato growing is 42.4 per cent, while the percentage of all soils in the area is 40.3 per cent in potatoes. This indicates that the type is used somewhat more extensively for potato growing than the average, a matter to be expected, since a larger proportion of the type is under cultivation than the average for the area.

Table III summarizes this information:

TABLE III.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops in the Freehold area.*

Crop group and crop.	All soils.		Sassafras loam.		Sassafras sandy loam.		Colts Neck loam.		Colts Neck sandy loam.		Collington loam.		Collington clay loam.		Collington sandy loam.		Freneau loam.	
	Acres.	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*
General farm crops	1,272.4	50.7	1,026.1	48.8	47.6	52.3	52.4	76.8	47.0	71.5	9.4	22.1	4.1	26.8	10.9	77.3	74.9	66.9
Hay and pasture	676.6	27.0	511.1	24.3	26.1	28.7	37.6	55.1	22.9	34.7	6.8	16.0	1.2	7.8	2.4	17.0	68.5	60.9
Corn	330.0	13.1	296.3	14.1	9.6	10.6	6.4	9.4	3.2	4.9	1.6	3.8	2.9	19.0	7.8	55.3	2.2	2.0
Wheat	121.7	5.0	109.0	5.2	4.1	4.5	6.9	10.1	1.6	2.5	1.0	2.3	.....	.....	.....	.....	2.1	2.0
Lima beans	111.2	4.6	94.9	4.5	.....	.....	.....	.....	19.3	29.4	.....	.....	.....	.....	.....	.....	.....	.....
Cowpeas	11.0	.4	6.0	.3	5.0	5.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rye	9.9	.4	5.6	.3	.....	.....	1.5	2.2	.....	.....	.....	.....	.....	.....	.7	5.0	2.1	2.0
Beets (stock)	6.0	.2	3.2	.1	2.8	3.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Truck crops	1,010.1	40.3	889.8	42.4	39.2	43.1	12.2	18.0	13.1	20.0	32.0	75.5	5.6	36.6	3.2	22.7	15.0	13.4
Potatoes	996.1	39.7	879.4	41.9	39.2	43.1	12.2	18.0	13.1	20.0	31.2	73.6	2.8	18.3	3.2	22.7	15.0	13.4
Cucumbers	4.6	.2	4.6	.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cabbage	4.0	.2	.7	.0	.....	.....	.....	.....	.....	.....	.5	1.2	2.8	18.3	.....	.....	.....	.....
Cauliflower	3.2	.1	3.2	.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Beans	2.2	.1	1.4	.1	.....	.....	.....	.....	.....	.....	.3	.7	.....	.....	.....	.....	.....	.....
Orchard and nursery	92.8	3.7	80.1	3.8	2.4	2.6	.....	.....	1.6	2.5	1.0	2.3	5.6	36.6	.....	.....	2.1	2.0
No annual crops	131.8	5.2	102.8	4.9	1.6	2.0	3.6	5.2	4.0	6.0	.....	.....	.....	.....	.....	.....	19.8	17.7
Garden and grounds	82.6	3.3	79.8	3.8	.8	1.0	1.5	2.2	.5	.8	.....	.....	.....	.....	.....	.....	.....	.....
Forest	38.6	1.5	18.8	.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19.8	17.7
No crop	10.6	.4	4.2	.2	.8	1.0	2.1	3.0	3.5	5.2	.....	.....	.....	.....	.....	.....	.....	.....
Grand total	2,507.1	99.9	2,098.8	99.9	90.8	100.0	68.2	100.0	65.7	100.0	42.4	99.9	15.3	100.0	14.1	100.0	111.8	100.0

The character of the agriculture of the locality is easily seen from the table of crop occupation. Hay and pasture, corn, wheat, and potatoes occupy 85.5 per cent of the total land area. Adding to these crops the areas in fruit crops and those occupied by farmsteads, the total is 94.2 per cent of the area, leaving only 5.8 per cent of the area occupied by other crops, of which the largest single acreage is that of Lima beans. (Figure 7.) In fact, the other miscellaneous crops of the area cover only 1.2 per cent of its total acreage.

It is at once evident that the Sassafras loam, occupying 87.6 per cent of the total land area, dominates the cropping system. In fact,

FIG. 7.—Bush Lima beans for canning, on Sassafras loam, near Freehold, N. J.

the area was selected for mapping because it gave an unusually good opportunity for the study of this type and its influence upon crop systems.

It was evident from a reconnoissance of southern New Jersey that the Sassafras loam was of leading importance in the production of corn, wheat, hay, and potatoes not only in Monmouth County but generally wherever it occurs in bodies of any size. Thus, in Mercer, Middlesex, Burlington, Camden, Gloucester, Salem, and Cumberland counties this soil is almost universally used over the greater part of its extent for the growing of these crops. Figures 8, 9, 10, 11, and 12 show the high state of cultivation and the productiveness of this soil when planted to these crops. In all locali-

ties where it is found in New Jersey it constitutes the standard soil type for this class of farming. In Monmouth County the speciali-

FIG. 8.—Field of American Giant potatoes on Sassafras loam, near Freehold, N. J. Yield over 275 bushels per acre.

zation in potato growing has been pushed a little further than in many other localities, but the extension during the last 10 years of

FIG. 9.—Digging and shipping American Giant potatoes, Sassafras loam, near Freehold, N. J. Yield over 275 bushels per acre.

the area devoted to potato growing in southern New Jersey has been largely upon this soil.

A similar mapping of the crop areas upon the Sassafras loam, if made in the vicinity of Robbinsville, Mercer County, or near

FIG. 10.—Red clover grown in rotation with corn, potatoes, and wheat on Sassafras loam, vicinity of Freehold, N. J. Yield 1½ to 2½ tons per acre.

Woodstown, Elmer, or Salem, in Salem County, would show essentially the same facts of crop occupation, even if the absolute figures differed slightly from those here shown.

FIG. 11.—Timothy and clover hay grown on Sassafras loam, near Freehold, N. J. Yield, in rotation with corn, potatoes, and wheat, 1½ to 2 tons per acre.

Certain facts are worthy of particular notice in the study of the cropping uses made of the different soil types.

In the case of potatoes, 39.7 per cent of the entire Freehold area is given to that crop. Potatoes occupy 41.9 per cent of the cropped area of the Sassafras loam.

Hay is second in area to potatoes, occupying 27 per cent of the entire area, but covering only 24.3 per cent of the cropped area of the Sassafras loam.

Wheat is the only small-grain crop grown to any significant extent. It covers 5 per cent of the entire area, but occupies 5.2 per cent of the cropped area of the Sassafras loam.

These departures from the normal of all types indicate a tendency to use as large an area of the Sassafras loam as is compatible with good methods of farming for the growing of potatoes. Corn, wheat, and hay are grown in a regular rotation with potatoes, the succession

FIG. 12.—Winter wheat on Sassafras loam, near Freehold, N. J. Yield 25 bushels to 35 bushels per acre on land heavily fertilized for potatoes.

and the duration of the crop occupation with each crop varying slightly with individual preferences. The strong tendency to keep the land in potatoes or corn is shown by the slight excess of the percentages in these crops on the Sassafras loam and the small deficiency of the percentage in hay compared with the standard figures for the area. In other words, this dominant and desirable soil type is kept in high-paying, cash crops for as much of the time as is possible in accordance with experience.

It should be stated that in central Monmouth County a special variety of Irish potato, the American Giant or "long stock," is grown. For this reason there is no opportunity to make any direct comparison of the local yields with those obtained in other localities

where the Irish Cobbler or "round-stock" potato is chiefly grown. Other things being equal, the Giant will normally outyield the Cobbler by 20 to 25 per cent.

The relationship of the Sassafras loam to the production of Irish potatoes as a main money crop can not be too strongly emphasized in a consideration of the uses of the soils of southern New Jedsey. Thus the business of growing potatoes has been developed to a high degree of specialization in central Monmouth County. That this is due, at least to some degree, to the presence of large areas of the Sassafras loam is shown by the unusually large acreage borne by that soil type. The special adaptation of this soil to potato production is well known in the region and is specifically recorded by Jennings in the report on the Soil Survey of the Freehold Area, New Jersey. He says:

> The soils on which the principal crops of potatoes are grown have been classed as Sassafras loam, sandy loam, and fine sandy loam, and the Collington loam, sandy loam, and fine sandy loam. Other types are used to some extent, but the highest yields are secured on these soils, especially on the loam soils of the different series.

Jennings also makes the distinction in his report that the early crop of potatoes is grown to a considerable extent on the Sassafras fine sand, fine sandy loam, and sandy loam in conjunction with other truck crops. He states with regard to the Sassafras loam that "it is without exception the heaviest-yielding potato soil in the State."

The personal investigations of the author in 1914 and 1915 would indicate that this statement is generally true of the type wherever it is found in southern New Jersey. An examination of the soil survey maps of the Freehold, Trenton, Camden, and Salem areas will show that all of the most important potato-shipping localities in southern New Jersey are located on or in the immediate vicinity of extensive areas of the Sassafras loam. This is true of Holmdel, Freehold, Englishtown, Dayton, Hightstown, Mount Holly, Moorestown, Mullica Hill, Elmer, Woodstown, Salem, and Shiloh.

In the majority of these localities the potato crop, whether American Giant or Cobbler, is grown on the Sassafras loam with the Collington sandy loam second in importance and the Sassafras sandy loam and fine sandy loam contributing a large part of the remainder of the crop. Upon these four soil types considerably more than one-half of the total potato crop of the State is annually grown.[1]

SOIL AND CROP SURVEY OF HARTFORD AREA.

In order to study the relationship existing between soils and crops in an area of mixed general farming and special crop production in

[1] For detailed statements with regard to the methods employed in potato growing in central New Jersey, the reader is referred to Farmers' Bulletin 472, of the U. S. Department of Agriculture, and to Bulletin 294, of the New Jersey Agricultural Experiment Station.

a favorable locality in southern New Jersey, a detailed map of the soils and the crops grown upon them was made in the vicinity of Hartford, Burlington County, N. J., in July and the early part of August, 1914.

The Hartford area is located along the line of the Amboy Division of the Pennsylvania Railroad about 12 miles east of Camden. It is adjacent to Rancocas Creek and about 5 miles south of the Delaware River. The area mapped covers about $3\frac{1}{4}$ square miles, or 2,259.1 acres. It lies within the area of the soil survey of the Camden Area, N. J., completed in 1915.

The Hartford Area occupies a somewhat dissected portion of a relatively flat-topped terrace along the lower course of Rancocas Creek. The surface of the land rises from the level of the stream in a southwesterly direction to an altitude of 90 feet at a distance of nearly one-half mile from the creek. The area mapped is divided into an eastern and a western division by the deep-cut channel of Parkers Creek which flows across it between steep bounding walls, through a flat-bottomed, marshy valley.

The altitudes along the railroad, which forms the southern boundary of the area mapped, range from 40 to 50 feet above tide level, gently rising toward the center of the upland to an extreme elevation of 80 feet at a point about one-half mile north of Hartford and of 90 feet about three-fourths of a mile northwest of Masonville. Aside from the steeper slopes along the banks of Parkers Creek and toward Rancocas Creek, the surface of the area is rolling to gently undulating. Some minor streams have cut small valleys through the upland and their courses are in some cases bordered by narrow swampy flats. Generally the surface drainage of the area is well established. Small depressions in the surface of the upland might be improved by the installation of tile underdrainage.

SOILS.

The Hartford area lies within the marl belt of central New Jersey. All of the surface materials are underlain at varying depths by beds of marl ranging from a loose, marly sand to a rather stiff, black marl. The rolling upland is covered by more recent deposits forming a part of the more elevated terrace intermediate in altitude between the broad terrace which borders the Delaware and the uplands to the south. The terrace covering varies in thickness from 5 or 6 feet down to a thin veneer over the underlying marl formations. East of Parkers Creek the marl formations either reach the surface or are so thinly covered that they form the deeper subsoils and thus give character to the soils mapped in that section.

In consequence, the soils of the rolling upland in the western part of the area mapped consist chiefly of the Sassafras loam and sandy

loam with associated areas of Elkton and Portsmouth types, while those of the eastern section include the Collington sand, sandy loam, and fine sandy loam.

Sassafras loam.—The Sassafras loam of the Hartford area does not differ materially from the same type as occurring in the Freehold area, except that there is possibly a smaller admixture of greensand marl in the deeper subsoil and the coloration of the subsoil is consequently a somewhat more reddish brown. The type occupies undulating to gently rolling uplands at elevations ranging from 50 to 90 feet above tide level and natural drainage is well established.

Sassafras sandy loam.—The Sassafras sandy loam differs slightly from the type as developed near Freehold, but is more nearly typical of the extensive areas found in other parts of southern New Jersey. The surface soil, near Hartford, to a depth of 10 or 12 inches, is a brown to dark-brown sandy loam. It is directly underlain by a pale-yellow sandy loam extending to a depth of 15 to 20 inches. This grades into reddish-yellow sandy clay. In the Hartford area a portion of the type occupying sloping ground contains an appreciable quantity of fine quartz gravel scattered through both soil and subsoil.

The surface of the type ranges from nearly level to decidedly sloping. Surface and internal drainage is well established.

Collington sand.—The surface soil of the Collington sand is a light-brown, medium to coarse sand, having a depth varying from 12 to 18 inches. It is underlain by a reddish-yellow medium sand subsoil. A small amount of glauconite is found in the deeper portions of the subsoil. In the Hartford area the total depth of surface soil and subsoil amounts to 6 feet or more over the greater part of the type.

The Collington sand occupies slopes and rolling, elevated positions. It is excessively drained and not well suited to agricultural uses. The greater part of its area is used to supply molding and builder's sand and agriculture is not well developed.

Collington sandy loam.—The Collington sandy loam in the vicinity of Hartford consists of the normal soil and a deep phase. The normal soil does not differ materially from the areas of the type as described for the Freehold area. The deep phase differs enough to warrant separate description. The soil is a yellowish, loamy sand. It is underlain at a depth of 14 to 30 inches by a yellow to reddish-yellow, friable sandy clay, which becomes compact and slightly tinged with green at 30 to 36 inches below the surface. The type occurs on level uplands and is well drained. It consists practically of a gradation between the normal Collington sandy loam and the Collington sand.

Collington fine sandy loam.—The surface soil of the Collington fine sandy loam, to a depth of about 12 inches, is a dark-brown fine

sandy loam. In the vicinity of Masonville it grades almost directly into a somewhat sticky coherent fine sandy loam, which is in turn underlain by a stiff, brown loam, or sandy clay subsoil. The entire subsoil has a considerable content of greensand.

Both level and sloping areas of the type occur in the Hartford area. Drainage is fairly well established.

The agricultural uses of the soil for orcharding, special crop production, and general farming are fairly representative of more extensive areas of the type elsewhere in southern New Jersey.

Elkton loam.—The surface soil of the Elkton loam is a light-brown to ash-colored heavy silty loam having a depth of 12 to 15 inches. The subsoil is a slightly heavier silty loam of a yellowish color becoming mottled yellow and gray at a depth of 24 to 36 inches.

The type occupies level to depressed areas of small extent, associated with the Sassafras loam and other upland types. It has a tendency to become baked and puddled when thoroughly dry at the surface and would be decidedly benefited by artificial drainage.

Portsmouth sandy loam.—The surface soil of the Portsmouth sandy loam, to an average depth of 6 to 9 inches, is a dark-gray to almost black sandy loam. It is usually well charged with partly decayed organic matter. The subsoil is prevailingly an almost white, sticky, sandy loam.

The type occupies depressed areas where drainage has not become well established. Through a considerable part of the year the deep subsoil, at least, is saturated with standing water.

A very small area of this type is found in the Hartford area and it is closely associated with better drained upland soils so that its uses are scarcely distinctive.

In addition to the distinct upland soil types there are quite extensive tracts of land along the walls of the Parker's Creek channel and elsewhere which are too steep and broken for cultivation. These areas are almost without exception timbered and were not considered in the study of the cropping of the different agricultural types.

Some of the creek bottoms were sufficiently extensive to justify mapping. They are moist, subject to inundation at times and liable to receive additions of soil material from time to time. The surface soils were usually dark loams or sandy loams while the deeper subsoils at least consisted of beds of greensand or glauconitic loam or clay. The only agricultural use of this material, mapped as the Freneau loam in the Hartford area, is for pasturage.

All these soils are representative of the same types in other parts of southern New Jersey, and conform for the most part to the general descriptions already given. In the case of the Collington sandy loam alone is there any decided departure from normal. The deep phase of this soil in the greater part of its area in the Hartford map

consists of a deep deposit of slightly coherent sand, loose at the surface but loamy below a depth varying from 14 to 30 inches. It is somewhat more droughty than the normal type and rather better suited to special truck or fruit crops than to the staple farm crops.

The absolute and the relative extent of the occupied areas of different soil types are given in Table IV:

TABLE IV.—*Extent of different soil types, Hartford Area.*

Soil.	Area occupied.	Proportion of total occupied area.	Soil.	Area occupied	Proportion of total occupied area.
	Acres.	*Per cent.*		*Acres.*	*Per cent.*
Sassafras loam	938.6	45.2	Collington sand	283.1	13.6
Sassafras sandy loam	532.0	25.6	Elkton loam	30.4	1.5
Collington sandy loam	41.8	2.0	Portsmouth sandy loam	30.4	1.5
Collington sandy loam, deep phase	115.9	5.6	Total	2,078.6	100.1
Collington fine sandy loam	106.4	5.1			

The total area covered by the map comprises 2,259.1 acres, while 2,078.6 acres were upland soils agriculturally occupied or capable of such occupation. The areas of rough broken land along the stream courses and those of the Freneau loam, in the stream bottoms, were not included in the estimation of the cropped acreages. The interpretation of facts is based upon the area of 2,078.6 acres.

USES OF SOILS.

Table V shows the total areas of the soil types and the crops supported by them and the percentage relationships of the tracts cropped or otherwise occupied.

TABLE V.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Hartford Area.*

Crop group and crops.	All soils.		Sassafras loam.		Sassafras sandy loam.		Collington sandy loam (deep phase).		Collington sandy loam.		Collington fine sandy loam.		Collington sand.		Elkton loam.		Portsmouth sandy loam.	
	Acres.	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*	*Acres.*	*Per ct.*
General farm crops	872.1	42.0	494.0	52.6	195.7	36.8	45.6	39.3	13.3	31.6	32.3	30.4	60.8	21.9	17.1	56.3	13.3	43.7
Hay	412.3	19.8	309.7	33.0	57.0	10.7	3.8	3.3	11.4	27.1	15.2	14.3	3.8	1.2	9.5	31.3	1.9	6.2
Pasture	24.7	1.2	5.7	.6	3.8	.7												
Corn	349.6	16.8	157.7	16.8	121.6	22.9	17.1	14.7	1.9	4.5	15.2	14.3	17.1	6.0	7.6	25.0	11.4	37.5
Rye	77.9	3.8	20.9	2.2	13.3	2.5	19.0	16.5					39.9	14.7				
Cowpeas	7.6	.4					5.7	4.9			1.9	1.8						
Truck crops	646.0	31.2	345.8	36.8	184.3	34.6	34.2	29.6	9.5	22.5	34.2	32.1	17.1	6.0	9.5	31.3	11.4	37.5
Potatoes	374.3	18.0	224.2	23.9	112.1	21.1	3.8	3.3	3.8	9.0	11.4	10.7	5.7	2.1	5.7	18.8	7.6	25.0
Tomatoes	148.2	7.1	60.8	6.4	55.1	10.4	11.4	10.0	1.9	4.5	11.4	10.7			3.8	12.5	3.8	12.5
Cabbage	43.7	2.2	30.4	3.2	1.9	.3					11.4	10.7						
Asparagus	24.7	1.2	9.5	1.0	9.5	1.8	3.8	3.3					1.9	.6				
Cantaloupes	19.0	.9	3.8	.5	5.7	1.0	5.7	4.9	3.8	9.0								
Beans	13.3	.6	9.5	1.0			1.9	1.6					1.9	.6				
Watermelons	7.6	.4					7.6	6.5										
Miscellaneous vegetables	5.7	.3											5.7	2.1				
Lettuce	5.7	.3	5.7	.6														
Sweet potatoes	1.9	.1											1.9	.6				
Squash	1.9	.1	1.9	.2														
Fruit crops	224.2	10.3	66.5	7.1	57.0	10.7	30.4	26.2	17.1	40.7	26.6	25.0	20.9	7.4	3.8	12.5	1.9	6.2
Orchard	169.1	8.1	26.6	2.9	57.0	10.7	30.4	26.2	17.1	40.7	13.3	12.5	20.9	7.4	3.8	12.5		
Berries	55.1	2.2	39.9	4.2							13.3	12.5					1.9	6.2
No annual crops	336.3	16.1	32.3	3.5	95.0	17.9	5.7	4.9	1.9	4.5	13.3	12.5	184.3	64.8			3.8	12.5
No crop	220.4	10.6	13.3	1.4	77.9	14.7	1.9	1.6					123.5	43.6			3.8	12.5
Garden and grounds	58.9	2.8	17.1	1.9	15.2	2.9	3.8	3.3	1.9	4.5	13.3	12.5	7.6	2.4				
Forest	57.0	2.7	1.9	.2	1.9	.3							53.2	18.8				
Grand total	2,078.6	99.6	938.6	100.0	532.0	100.0	115.9	100.0	41.8	99.3	106.4	100.0	283.1	100.1	30.4	100.1	30.4	99.9

Freneau loam (chiefly in permanent pasture), 121.6 acres.
Rough broken land (chiefly in forest), 95 acres.

It will be seen from these tables that nearly one-half of the total area occupied consists of loams—the Sassafras loam and the Elkton loam. These more retentive soils are normally used in the section for the production of hay, corn, potatoes, tomatoes, and other staple or late truck crops. The remaining soils grade from a fine sandy loam to a loose, deep sand. The area thus presents a sufficient variation in soil type characteristics to permit of considerable diversity in cropping while at the same time it is dominated by the finer grained and more retentive soils.

The table of occupation acreages is in close accord with what might be expected from the table of soil type acreages. The general farm crops occupy 42 per cent of the area, while truck and fruit crops occupy 41.5 per cent. The large area of land not under cultivation results entirely from the fact that the greater part of the Collington sand is more profitably worked to furnish molder's and builder's sand than as an agricultural soil. A porous sand of this character is too unretentive of moisture to support even the early truck crops to good advantage.

The percentage of crop acreages established by the figures for all types constitutes a normal for the area and region. When comparison of the individual percentages of crop occupation of the different types is made with this standard it is evident that the Sassafras loam is more extensively used for growing the general farm crops than is any other really important type in this locality. It supports general farm crops to the extent of 52.6 per cent of its acreage, as compared with 42 per cent for the entire area and with 36.8 per cent on the Sassafras sandy loam, which is the next most extensive type of soil.

With respect to special or truck crops, the Sassafras loam supports them to the extent of 36.8 per cent of its area as compared with 31.2 per cent for the entire area and 34.6 per cent on the Sassafras sandy loam.

Among specific crops, it is notable that hay occupies the largest area of any single crop for the entire area for the Sassafras loam, Collington sandy loam, and Elkton loam, while it is relatively unimportant as a crop on any other soil type within the limits of this survey.

The potato crop ranks second to hay in total acreage and leads corn slightly. There is a marked concentration of the potato acreage on the Sassafras loam and a slight excess in proportionate acreage on the Sassafras sandy loam. This fact supports the results as obtained from the survey of the detailed area near Freehold. These two types are recognized as especially suited to the growing of the crop. It is known in the Hartford area that the Irish Cobbler matures at a slightly earlier date on the Sassafras sandy loam,

but usually gives a larger yield upon the Sassafras loam. In consequence of the higher prices at the earlier dates the cash return per acre is about equal for the two types. Both are more highly esteemed for potato growing than any other soils included in this survey. (Figs. 13 and 14.)

The Sassafras loam is the standard type for corn growing, carrying exactly the same relative percentage as that found for all types. Corn is the leading crop in acreage on the Sassafras sandy loam and the Portsmouth sandy loam and of equal importance with hay on the Collington fine sandy loam.

Orchard and fruit crops are decidedly concentrated on the Collington sandy loam and on the deep phase of that type, while the Sassafras sandy loam is also an important type for fruit culture.

Tomatoes are somewhat concentrated on the Sassafras sandy loam, where they occupy 10.4 per cent of the area of the type; and on the Sassafras loam, where they cover 6.4 per cent. Tomatoes are grown for direct marketing as a truck crop in this section, only the last of the crop usually finding its way to the canning or preserving factories.

The figures of crop usage for these different soils emphasize the fact that the heavier, loamy types are most esteemed for the production of such crops as hay, corn, potatoes, and cabbage (fig. 15); that the sandy loam soils are suited to a wide diversity of crops, being adapted to the general farm crops and to a considerable range of special crops, including fruit, and that the more sandy soils are best devoted to special crop production, notably to the growing of the early truck crops. It is also apparent that the more sandy soils are liable to be too droughty even for such uses.

The soils mapped in the Hartford area may evidently be grouped with respect to their crop utilization as follows:

General-farming soils—Sassafras loam, Elkton loam, and Portsmouth sandy loam. *Truck soils*—Collington fine sandy loam and Collington sandy loam, deep phase. *Fruit soils*—Collington sandy loam. *Mixed-purpose soils*—Sassafras sandy loam.

The Hartford area is thus seen to represent a somewhat varied assortment of agricultural conditions and cropping practices which are demonstrably capable of correlation with the soil types which occupy the area.

Prevalence of general farm crops is due largely to the existence in dominant area of the Sassafras loam, a well-drained but retentive, fertile soil. Specialization toward the production of potatoes and tomatoes as the important cash crops is rendered possible by the dominance of the Sassafras loam and sandy loam. Extensive development of orcharding and fruit growing is favored by the presence of the areas of the Collington sandy loam, deep phase, and the Sassafras sandy loam. Lack of agricultural use of a considerable

area of land is specifically due to the presence of a large area of the Collington sand, a type too droughty even for the growing of

FIG. 13.—Cultivating potatoes (Irish Cobbler) on Sassafras sandy loam, near Hurffville, N. J.

the early truck crops. Steep sloping areas are left in forest, and poorly drained areas are well utilized for grazing.

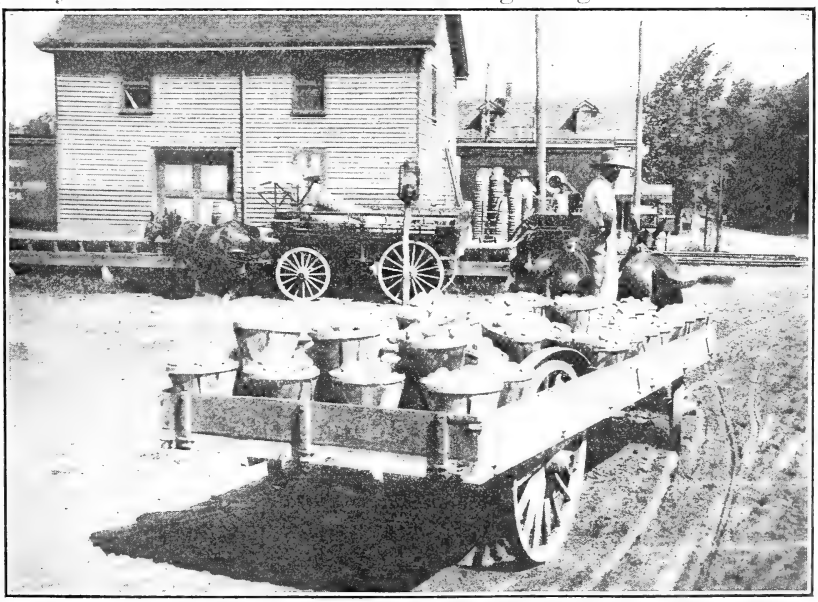


FIG. 14.—Shipping Irish Cobbler potatoes, Hartford, N. J.

In comparison with the Freehold area, the Hartford area is one of greater diversity, both of soil conditions and of resulting crop uses.

SOIL AND CROP SURVEY OF THE THOROFARE AREA.

A combined soil and crop map was made of an area surrounding Thorofare in order to illustrate the relationship between soils and crops in one of the most intensively farmed areas in southern New Jersey.

The Thorofare area is in an angle formed between the Delaware River and the lower course of Woodbury Creek, near its mouth. It lies immediately to the west of Woodbury and about 12 miles southwest of Camden. It is on the West Jersey & Seashore Railroad and easily accessible by highway to the Philadelphia markets. Its accessibility to market is equal to that of the Freehold or the Hartford areas.

Practically all of the area selected lies on the low terrace which borders the Delaware River and only a small tract along the south-

FIG. 15.—Late cabbage on Collington fine sandy loam, near Moorestown, N. J.

ern border of the map rises to elevations greater than 30 feet above tide level.

The general surface of the upland portion rises gently in a southeasterly direction from the tide marsh which borders the river. Only along Woodbury Creek is there any sharp rise from marsh to upland. There the rise varies from 5 to 25 feet and is accomplished in a low cliff, which gradually becomes lower toward the mouth of the creek.

From the river to Thorofare the surface is a low, slightly undulating plain, the highest altitudes of which are reached between Thoro-

fare and Woodbury Creek in a low ridge reaching to 20 or 25 feet above tide level. Southward from Thorofare a gentle slope toward the interior upland begins, carrying the extreme elevation of the tract mapped to an altitude of 40 feet.

SOILS.

All of the lower part of the area surveyed lies within the terrace formation which borders the Delaware River and Bay. The basal materials in this vicinity consist of two rather heavy beds; one is a black, micaceous clay of massive structure and greasy appearance, which sometimes carries rather large amounts of greensand, while the other, higher bed, is also dark and micaceous but lacks the greensand. Both layers affect the underdrainage of the soil types in the area. Upon the lower terrace, slight hollows and depressions remain more moist than the general condition because of the near presence of the clay. Upon the slopes the upper clay bed sometimes comes near enough to the surface to affect subsoil drainage and to constitute a rather sticky subsoil material underlying the surface soils at varying depths.

The actual soil materials of the greater part of the area are to be ascribed to later stages of the deposition of river or estuarine sediments. These sediments give rise to the sandy and sandy loam soils of the upland. These constitute a thin covering over all but the steepest slopes. The soils of the area thus owe their origin primarily to the deposition of the older, marine beds and to the later covering of these materials by a thin veneer of later river or bay deposits.

Four soil types occupy the arable upland portion of the Thorofare area. These are the Sassafras sand, Sassafras sandy loam, Portsmouth sandy loam, and Collington fine sandy loam. The last covers but a small area. In addition a considerable area of Tidal marsh, some swampy stream bottoms, and the rough, broken land occurring along the slopes from the upland to the streams were necessarily included.

Sassafras sand.—The surface soil of the Sassafras sand consists of a merely, medium sand of a brown to yellowish-brown color and is 6 to 10 inches deep. The surface soil grades into a pale yellowish brown sand, usually rather loose in structure. At a depth ranging from 18 to 24 inches below the surface, the subsoil usually consists of a reddish-yellow to orange fine sand. There is little difference in texture between the surface soil and subsoil. On account of the incorporation of large amounts of organic manures in the surface soil throughout this region the surface soil frequently seems somewhat more coherent and loamy than the subsoil and its color is somewhat darker than the normal for the type.

Near the margins of the Sassafras sand in the Thorofare area and in small depressions throughout its area there are small tracts where the presence of underlying clay becomes evident through the somewhat sticky condition of the deep subsoil. This clay layer aids in the retention of moisture in soil and subsoil while it is usually sufficiently covered by sandy materials to permit of good to excessive drainage of the type.

The surface of the Sassafras sand is nearly level in the Thorofare area. Slight ridging exists, but not sufficient to interfere with cultivation.

The area is representative of considerable tracts of the type which exist along the low terrace bordering the Delaware River, particularly in the vicinity of the mouths of the larger tributary streams. In all of these localities the type is fully occupied for the production of intensively tilled crops. Trucking has been intensively developed on this soil from the vicinity of Burlington, N. J., to that of Penns Grove, N. J. The Thorofare area is representative of this belt.

Sassafras sandy loam.—The Sassafras sandy loam is in most respects identical with the areas described in the Hartford area. It occurs along slopes at the higher elevations near the southern boundary of the Thorofare area. Surface drainage is good, while the heavier subsoil assists in maintaining a good supply of moisture in both soil and subsoil. Practically all of the type is under cultivation.

Collington fine sandy loam.—The surface soil of the Collington fine sandy loam contains a little more fine sand than is typical, owing to a moderate amount of wind action in piling up low ridges of fine sand near the larger streams. The subsoil is a dark-brown, greasy clay to a depth of 18 inches, where it is underlain by a brown loam or clay loam distinctly marked by the presence of greensand.

The surface of the type is nearly level and drainage is well established.

Portsmouth sandy loam.—This soil occupies areas where drainage is poorly established. It is marked by a dark, mucky surface soil, as in the Hartford area, and by a gray to nearly white sandy loam subsoil. The latter is nearly always saturated with standing water.

Swamp.—The areas mapped as Swamp consist of small tracts of poorly drained stream bottoms. They are either timbered or used for pasture. No tilled crops are grown upon them.

Tidal marsh.—Extensive areas of Tidal marsh border the upland both along Woodbury Creek and along the Delaware River. In favorable situations these areas have been diked and drained and some areas of hay are annually cut. The chief use is for pasture, and adjacent upland farms, devoted to truck growing, frequently main-

tain some dairy cows from the pasturage and forage crops furnished by the diked lands. The areas of Tidal marsh are not included in the measurements of the detailed crop and soil map.

None of these soils differ materially from their normal characteristics in southern New Jersey, except that the outer margins of the Sassafras sand areas show a sticky clay underlying the type at a depth ranging from 24 to 36 inches. This narrow belt of land expresses the thinning out of the material and the near approach to the surface of the older, underlying clay beds.

A part of the Tidal marsh is diked and used for hay production and for grazing. The swampy stream bottoms are used for grazing, while the steeper slopes from upland to stream bottom are chiefly in forest. Nearly every available acre of upland is occupied by some crop or by the homestead and necessary lanes.

The total and relative areas of the different soils are shown in Table VI:

TABLE VI.—*Extent of different soil types, Thorofare area.*

Soil type	Area occupied.	Proportion of total occupied area.
	Acres.	*Per cent.*
Sassafras sand	940.5	69.3
Sassafras sandy loam	248.9	18.3
Portsmouth sandy loam	123.5	9.1
Collington fine sandy loam	45.6	3.3
Total	1,358.5	100.0

USES OF SOILS.

In the Thorofare area the Sassafras sand dominates; the Sassafras sandy loam is the only other important upland soil, and the Portsmouth sandy loam and the Collington fine sandy loam are areally of decidedly less importance. The study of the crop uses of the soils of this area is essentially a study of contrasts between the Sassafras sand and the Sassafras sandy loam.

The character of the agriculture supported by the more sandy soils along the low terrace which borders the Delaware River from Trenton to the vicinity of Penns Grove is well represented by the soil and crop map of the Thorofare area.

Table VII shows the absolute and relative importance of each crop within the area surveyed and upon each of the tilled, upland soil types.

TABLE VII.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Thorofare Area.*

Crop group and crop.	All soils.		Sassafras sand.		Sassafras sandy loam.		Portsmouth sandy loam.		Collington fine sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	260.3	19.1	81.7	8.7	127.3	51.1	47.5	38.5	3.8	8.3
Corn	102.6	7.6	51.3	5.5	41.8	16.8	9.5	7.7	.....	.....
Hay	95.0	7.0	15.2	1.6	43.7	17.5	32.3	26.2	3.8	8.3
Alfalfa	7.6	.5	7.6	.8	.....	.....	.....	.....	.....	.....
Pasture	7.6	.5	.....	.....	3.8	1.5	3.8	3.1	.....	.....
Oats	19.0	1.4	1.9	.2	17.1	6.9	.....	.....	.....	.....
Rye	15.2	1.1	5.7	.6	9.5	3.8	.....	.....	.....	.....
Wheat	13.3	1.0	.....	.....	11.4	4.6	1.9	1.5	.....	.....
Truck crops	855.0	62.9	693.5	73.6	77.9	31.2	49.4	39.7	34.2	75.0
Asparagus	195.7	14.4	191.9	20.4	1.9	.7	1.9	1.5	.....	.....
Sweet potatoes	165.3	12.2	153.9	16.4	7.6	3.1	3.8	3.1	.....	.....
Tomatoes	146.3	10.7	104.5	11.1	26.6	10.7	5.7	4.6	9.5	20.8
Cantaloupes	104.5	7.7	93.1	9.9	5.7	2.3	.....	.....	5.7	12.5
Potatoes	57.1	4.2	1.9	.2	32.3	13.0	9.5	7.7	13.3	29.2
Peppers	34.2	2.5	26.6	2.8	1.9	.7	5.7	4.6	.....	.....
Eggplant	30.4	2.2	26.6	2.8	1.9	.7	1.9	1.5	.....	.....
Watermelons	26.6	2.0	24.7	2.6	.....	.....	1.9	1.5	.....	.....
Onions	24.7	1.9	19.0	2.0	.....	.....	1.9	1.5	3.8	8.3
Beans	20.9	1.5	19.0	2.0	.....	.....	1.9	1.5	.....	.....
Cabbage	13.3	1.0	1.9	.2	.....	.....	9.5	7.7	1.9	4.0
Cucumbers	13.3	1.0	11.4	1.2	.....	.....	1.9	1.5	.....	.....
Squash	11.4	.8	9.5	1.0	.....	.....	1.9	1.5	.....	.....
Miscellaneous vegetables	11.4	.8	9.5	1.0	.....	.....	1.9	1.5	.....	.....
Fruit crops	121.6	9.0	72.2	7.6	36.1	14.5	9.5	7.7	3.8	8.3
Orchard	117.8	8.7	72.2	7.6	34.2	13.8	7.6	6.2	3.8	8.3
Berries	8.1	.3	.....	.....	1.9	.7	1.9	1.5	.....	.....
No annual crops	121.6	9.0	93.1	9.9	7.6	3.0	17.1	13.8	3.8	8.3
Garden and grounds	81.7	6.0	66.5	7.1	7.6	3.0	3.8	3.1	3.8	8.3
Forest	28.5	2.1	17.1	1.8	.....	.....	11.4	9.2	.....	.....
No crop	11.4	.9	9.6	1.0	.....	.....	1.9	1.5	.....	.....
Grand total	1,358.5	100.0	940.5	99.8	248.9	99.8	123.5	99.7	45.6	99.9

Swamp (chiefly pasture), 79.8 acres.
Rough broken land (chiefly forest), 43.7 acres.

Several important facts are made evident by this table: First, the truck crops occupy 62.9 per cent of the total cropped area while the general farm crops cover but 19.1 per cent. Second, the four crops of greatest acreage are asparagus, sweet potatoes (figures 16 and 17), tomatoes, and cantaloupes (figure 18). It is not until fifth place is reached that a general farm crop appears. Corn occupies this position. It should be stated that the field crop, or "horse corn," as it is locally known, and some areas of sweet corn, a truck crop, were both mapped under the single heading. If alfalfa and other classes of hay are combined, the total acreage in hay exactly equals the total acreage in corn. Third, the variety in cropping is also notable (figures 19 and 20). Thirteen different truck crops are grown to an extent sufficient to justify separate mapping within this area of less than 1,500 acres. Seven general farm crops are also grown and orchards occupy an important area. Fourth, the small area covered by forest and by land not in crops is noteworthy. In fact the area given to the necessary grounds and gardens of the homestead is

double the area which is otherwise unoccupied by annual crops or orchard.

FIG. 16.—Harvesting and sorting sweet potatoes on Sassafras sand, near Thorofare, N. J.

These facts clearly demonstrate the intensity and specialization of the cultivation of the land in the Thorofare area.

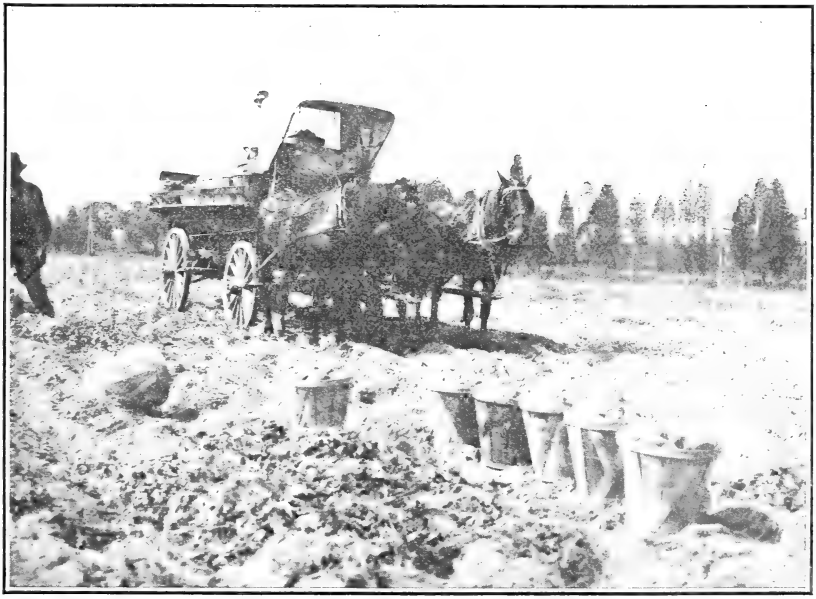


FIG. 17.—Loading early sweet potatoes for the city market, near Thorofare, N. J.

Some very striking features of individual uses of soils for crops are also shown by these tables. The Sassafras sand is the soil pre-

ferred by the intensive truck farmer. The truck crops occupy 73.6 per cent of its total area. Asparagus leads in importance, covering

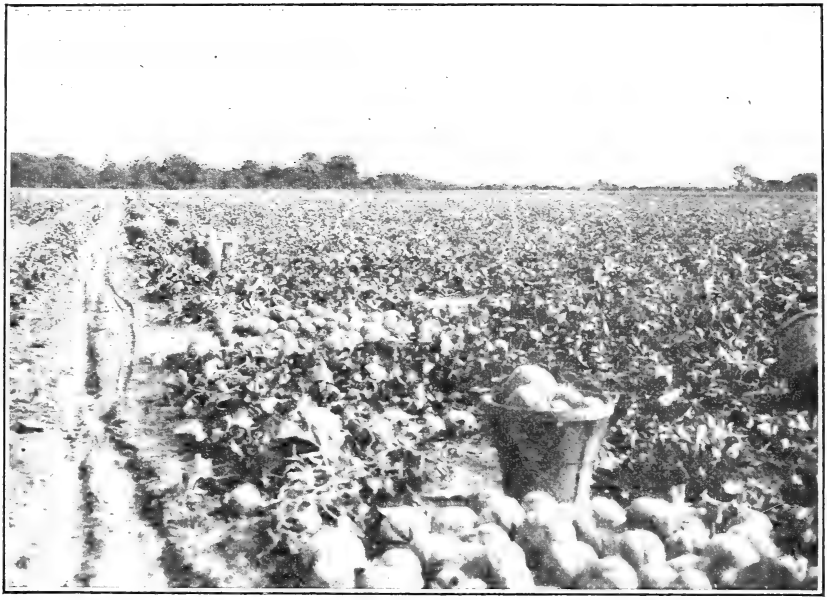


FIG. 18.—Cantaloupes on Sassafras sand, near Clarksboro, N. J.

20.4 per cent of the type. Sweet potatoes, tomatoes, and cantaloupes are of decided importance. In fact the acreage given to each of these

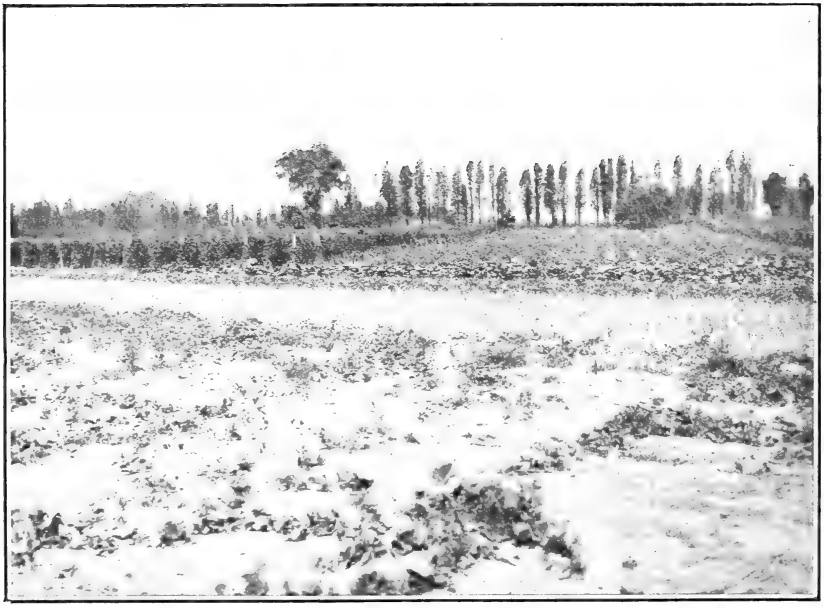


FIG. 19.—Intensive cropping on the Sassafras sand, Thorofare, N. J. A locality of varied crops and small fields.

four crops considerably exceeds that occupied by all of the general farm crops.

Yet certain truck crops are discriminated against as markedly as these four are preferred for production on this soil.

Irish potatoes only occupy 1.9 acres on the Sassafras sand, compared with 32.3 acres on the Sassafras sandy loam, or 13 per cent of its area; 13.3 acres on the Collington fine sandy loam, or 29.2 per cent of its area; and 9.5 acres on the Portsmouth sandy loam, or 7.7 per cent of the area of that type. This distinction is in full accord with the conclusions reached in connection with the observations concerning the general region.

The acreage in cabbage is concentrated on the Portsmouth sandy loam—a moist, low-lying soil—this crop appearing only to a limited extent on the Sassafras sand and the Collington fine sandy loam.

The absence of anything but a purely accidental area of asparagus from all soil types except the Sassafras sand is decidedly significant.

FIG. 20.—Sweet corn interplanted with string beans on Sassafras sand.

Wherever possible the other soils of the area have been avoided for setting asparagus beds and only where small areas of other types were closely associated with this chosen asparagus soil is any acreage of the crop discovered.

The contrast between the crop occupation of the Sassafras sand and the Sassafras sandy loam is marked. The former type is absolutely dominated by truck crops; the latter carried 51.1 per cent of its area in general farm crops. On the former, asparagus is the leading crop; on the latter, hay leads in acreage and corn is a close second. Among truck crops, potatoes cover only 1.9 acres on the Sassafras

sand, while they occupy 32.3 acres on the Sassafras sandy loam, a type of approximately one-fourth its total area. It is interesting to note that tomatoes are of almost equal importance upon the two types. But observation shows that the earliest pickings are made on the Sassafras sand while the medium early and the later crops are chiefly harvested from the Sassafras sandy loam. These relationships to the growing of the potato and tomato crops are in accord with the recorded facts of the Hartford area. The Sassafras sandy loam, therefore, may be characterized as a soil well suited to the production of the general farm crops and of considerable value for the production of the mid-season and later truck crops such as tomatoes and potatoes. It is an excellent soil for the use of the farmer who desires to combine the growing of special cash crops with the practice of general farming and fruit growing.

Practically all of the Portsmouth sandy loam in the Thorofare area is so distributed in long, narrow areas that it does not receive distinctive treatment. Yet it is worthy of note that the general farm crops and the truck crops are of almost equal area upon this soil. Hay occupies more than one-fourth of the entire area of the type. Forested areas are next in extent. Corn is grown to an equal extent with cabbage and potatoes. Tomatoes and peppers are the only other important crops grown. Thus, the tendency is toward the growing of general farm crops and late truck crops upon the Portsmouth sandy loam. Where properly drained, the type is well suited to this utilization.

SOIL AND CROP SURVEY OF THE SWEDESBORO AREA.

In order that a study might be made of the soils in an area largely devoted to the growing of sweet potatoes (figures 21 and 22) and tomatoes (figures 23, 24, 25, and 26) in addition to the general farming crops, a detailed map of the soils and crops was made immediately north of Swedesboro, Gloucester County, in the summer of 1915. The map represents the actual crops and soil conditions as they existed between the 1st of July and the 15th of August.

The Swedesboro area is located on the Salem Branch of the West Jersey & Seashore Railroad, about 20 miles south of Camden. It lies along the north bank of Raccoon Creek at a distance ranging from 4 to 6½ miles from the Delaware River, and occupies a rolling and elevated section consisting of three rather distinct topographic features.

The tide rises in Raccoon Creek to the eastern limits of the area surveyed and the immediate banks of the creek are bordered by Tidal marsh, part of which has been reclaimed so that it may be used for pastures and for the cutting of hay, while the remainder furnishes some pasturage at low tide.

Immediately along the flooded areas the ground rises rather sharply to a low terrace which extends interruptedly along the course of the

FIG. 21.—Cultivating and ridging up sweet potatoes on Sassafras coarse sandy loam near Swedesboro, N. J.

stream. The frontal slope to tidewater areas is usually rather steep, comprising a low cliff which is not included with the tilled upland

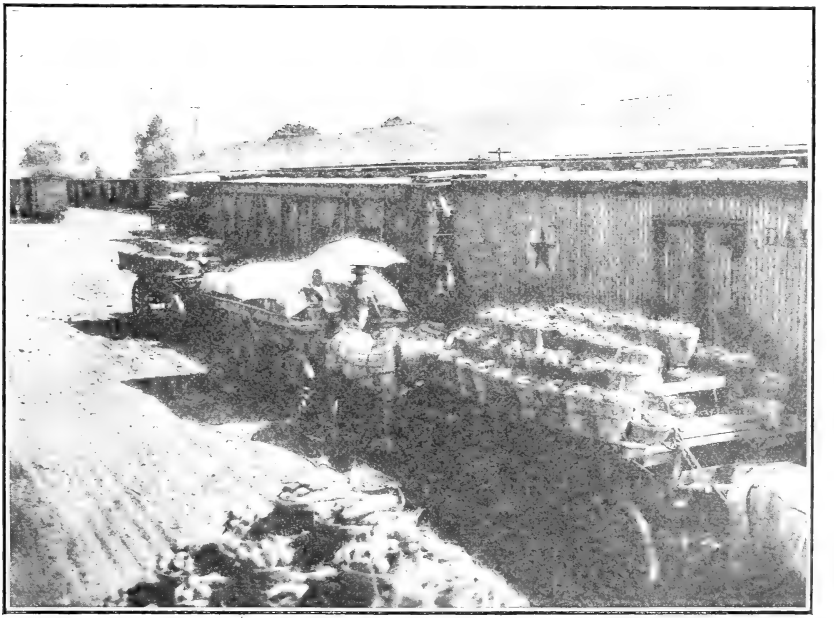


FIG. 22.—Hauling sweet potatoes to Swedesboro, N. J., for shipment. The largest sweet potato shipping point in southern New Jersey.

but is chiefly wooded. Above this frontal slope the terrace rises gently to altitudes between 40 and 50 feet above tide level. The

terrace is crossed by many local streamways and is thus rendered discontinuous and imperfect. It represents an inland extension along

FIG. 23.—Early truck-crop tomatoes on Sassafras sandy loam and Collington fine sandy loam, near Swedesboro, N. J.

Raccoon Creek of the better-defined terrace which borders the Delaware River in this vicinity.

FIG. 24.—A good crop of canning tomatoes on Sassafras fine sandy loam, near Penns Grove, N. J.

Practically all that portion of the area which lies to the northwest of the Woodbury-Salem pike consists of a gently undulating and

slightly dissected portion of a higher terrace. This terrace also extends to the southeast of the pike to a distance ranging from one-

FIG. 25.—Selling truck-crop tomatoes to the highest bidder. A common street scene in Swedesboro, N. J., during July and early August.

fourth to one-half mile. The general level of the surface of this physical division varies between 50 feet and 95 feet above tide level.

FIG. 26.—Delivering canning-crop tomatoes at a Salem County, N. J., canning factory.

The terrace form is most distinctly seen to the northwest of the pike. Evidences of the same physical feature may be detected at higher

levels along the Raccoon Creek drainage in the extreme southeastern corner of the detailed survey.

Rising above any of these elevations, a high ridge of land extends almost from the margin of the Raccoon Creek swamps, northeasterly across the area to its extreme northeastern corner. The summit of this ridge is clearly indicated upon the soil map by the areas occupied by the Colts Neck gravelly sandy loam. From this summit the land surface slopes rather steeply down to the upper levels of the higher terrace.

It is probable that the extreme summit of this higher ridge represents remnants of an older formation which has elsewhere been removed by long-continued erosion. The slopes are undoubtedly formed from soil wash from this higher and partly destroyed formation, mingled with a considerable amount of material which has been brought to its present condition through the weathering of underlying marl formations. Such areas are particularly in evidence in the southeastern third of the area, where considerable tracts of both the Collington fine sandy loam and the Colts Neck loamy sand are found. These two types owe their origin and characteristics to the influence of the underlying marl formations, representing chiefly different degrees of weathering to which the original materials have been subjected. Where the marls are still comparatively fresh they retain much of their original greenish color. Where they have been more thoroughly weathered they have assumed a decidedly reddish tinge, which serves to differentiate the resulting soils as members of the Colts Neck series.

The greater part of the drainage of the area is accomplished through the medium of several small streams. Those found in the eastern and southern parts of the area are tributary to Raccoon Creek. Their courses are relatively short and their gradients are steep. At their lower ends they have cut deep gorgelike channels through the lower terrace. At their upper ends they usually head in slight gullies or in springy areas within the upland. The streams of the remainder of the area flow almost directly to the Delaware River. They also head in springy areas in the upland. The land along their courses through the area mapped in detail is somewhat swampy. Their banks are low but steep.

Drainage is effective over all of the upland, and the run-off is so rapid upon the steeper slopes that heavy rains are likely to do some damage through erosion of soil from the fields.

This is particularly the case along the flanks of the ridge crossing the southeastern corner of the area.

SOILS.

The underlying formations which constitute the basal structure of the Swedesboro area consist of distinct layers belonging to the marl formations which extend across the State from the Raritan Bay to the Delaware River. In the immediate vicinity of Swedesboro these beds consist of a lower layer of dark-colored, nonglauconitic clay, only exposed at the surface in a limited area; of a somewhat glauconitic sand, which underlies the upland along both sides of the Woodbury pike; and of a distinctly glauconitic, or marl sand which occurs along the slopes to Raccoon Creek and also along the slopes from the high ridge to the upper rolling terrace. The marly material from this formation gives rise to the soils of the Collington series either where it outcrops directly at the surface or where the same material has been mixed to any considerable extent with the later terrace materials.

The soil-forming materials of the area are derived chiefly from later river or estuarine deposits which cover the older formations to varying depths, usually ranging from a few inches to an extreme depth of 5 to 15 feet.

The greater part of the soils of the Swedesboro area, including nearly all of the rolling upland of the higher terrace level, has been formed from these later deposits, while the soils of the lower terrace are more recent and have been formed from materials derived from all of the older formations.

Thirteen distinct soils were mapped in the detailed soil and crop map of the Swedesboro area. These fall into four main groups. The most extensive and agriculturally the most important soils belong to the Sassafras series, represented by six different types. The Collington series is represented by two types and a phase of one of them. The Colts Neck series has two soils in the area, while the Portsmouth series is represented by only one. In addition there are accessory areas of Rough, broken land, chiefly in forest, and of Tidal marsh, used for the growing of hay and for pastures.

Sassafras coarse sandy loam.—The surface soil of the Sassafras coarse sandy loam, to an average depth of about 10 inches, consists of a coarse, loamy sand of a brown to yellowish-brown color. There is frequently a scattering of fine gravel over the surface. It does not interfere with cultivation. The subsoil to a depth of 30 to 32 inches is a somewhat more coherent, loamy sand containing some fine gravel. At about 30 inches in depth the subsoil becomes decidedly more coherent and a sticky sandy loam subsoil is encountered.

The surface of the type is either gently sloping or nearly level, although slight depressions exist within its area. Drainage is com-

monly good to rather excessive. Seepage waters rise nearly to the surface at the foot of slopes, rendering the lower lying portions of the type somewhat more moist than the general average. The natural tendency of the type to excessive drainage has been corrected in the Swedesboro area through the incorporation of large quantities of stable manure and of green crops plowed into the surface soil.

The type is practically all cleared and used for intensive forms of crop production.

Sassafras sandy loam.—The surface soil of the Sassafras sandy loam is a brown, loamy, medium sand, 6 to 8 inches deep. It is somewhat more sandy than in either the Hartford or the Thorofare area. The subsoil is a loamy yellow sand to a depth of about 18 inches, where it is underlain by a sticky, coherent, sandy loam of a reddish-yellow color. This is locally termed a "clay." A small amount of gravel is found in both soil and subsoil.

The surface of the type is gently sloping to nearly level. Drainage is well established but is not usually excessive.

Sassafras gravelly coarse sandy loam.—The Sassafras gravelly coarse sandy loam occupies gravelly slopes and knobs. The surface soil to a depth of 5 to 10 inches is a yellowish-brown sandy loam filled with fine gravel. The pebbles range in size from one-fourth to 1½ inches in diameter. The immediate subsoil is a yellow, gravelly loamy sand or gravelly sandy loam. The deeper subsoil usually consists of a somewhat compacted and dense gravel bed containing only a moderate amount of finer grained material.

The type occurs on slopes or as small knolls and knobs, and drainage is complete to excessive.

Sassafras coarse sand.—The surface soil of the Sassafras coarse sand, to an average depth of about 8 inches, is a brown to yellowish-brown coarse sand. It is scarcely coherent and constitutes the most sandy soil in the area. The subsoil, extending from a depth of 8 to 36 inches, consists of a medium yellow sand, slightly orange in color in the lower depths. A small amount of fine gravel occurs in the deep subsoil.

The type occurs chiefly on low ridges associated with the Sassafras coarse sandy loam and sandy loam. It is well to excessively drained.

Sassafras fine sandy loam.—The surface soil of the Sassafras fine sandy loam, to a depth of about 8 inches, is a brown fine sandy loam containing small quantities of fine gravel. From 8 to 16 inches the subsoil is a reddish-yellow, sticky, fine sandy loam. This is underlain to a depth of 3 feet or more by a stiff reddish-yellow clay.

The surface of the type is gently sloping and the drainage is good. The stiff subsoil interferes somewhat with internal drainage.

Sassafras loam.—The Sassafras loam is not typical in the Swedesboro area, comprising only two small tracts of loamy wash from the upland, accumulated in slight hollows.

Colts Neck loamy sand.—The surface soil of the Colts Neck loamy sand, to a depth of about 8 inches, is a reddish-brown loamy sand. The coarse and medium grades of sand are plentiful and a small admixture of fine gravel occurs in the surface soil. The subsoil, to a depth of about 20 inches, is a reddish-brown to reddish-yellow rather coarse loamy sand. At a depth of 20 to 28 inches this grades into a sticky, mortarlike sandy loam of a decidedly reddish color. A small amount of gravel is present in the subsoil and in the lower part there is a tendency toward cementation by iron salts.

The type occupies gentle slopes along the ridge which crosses the area. The greater part of the type lies well for cultivation, but small tracts are rather steeply sloping and inclined to become washed by heavy rains. Drainage is excellent.

This is the principal "red land" soil in the region, and it is especially esteemed for the growing of sweet potatoes, which are of the highest quality.

Colts Neck gravelly sandy loam.—The Colts Neck gravelly sandy loam is characterized by a dark, rusty red gravelly loam surface soil, having an average depth of about 5 inches. It is underlain to a depth of 18 inches by a dark-red, sticky, sandy loam, containing a considerable amount of gravel and fragments of iron crust. It is frequently hardened through the deposition of iron salts as cement. Usually below 18 or 20 inches the deep subsoil is a sticky red clay, filled with gravel and broken iron crust. The gravel in this type is a honey-colored quartz gravel ranging in size from one-half inch to 2 inches in diameter.

The Colts Neck gravelly sandy loam occupies the highest ridges in the area and forms separated knolls of some elevation. It has suffered to some extent from erosion and is quite generally left in forest. It has been utilized to a limited extent for peach orchards.

Collington fine sandy loam.—The Collington fine sandy loam does not differ materially in the Swedesboro area from its occurrences in the Hartford and Thorofare areas, except that there are local accumulations of fine sand on some of the slopes which render the total depth of the surface soil greater than is usual. There are within the limits of the Collington fine sandy loam certain steep slopes that have suffered from considerable erosion. On these slopes the surface soil is only 2 or 3 inches thick and in many cases the compact subsoil is exposed. This phase is of no great importance either in the Swedesboro area or elsewhere in southern New Jersey.

Collington gravelly sandy loam.—The surface soil of the Collington gravelly sandy loam, to a depth of about 6 inches, is a brown sand, well filled with small white quartz pebbles. The subsoil, to a depth of about 24 inches, is a greenish-yellow gravelly sand. It is usually compact and so filled with gravel as to be almost impenetrable. This rests upon a greenish-yellow sticky sandy loam or upon the unweathered greensand at a depth of about 24 inches.

The type occurs as narrow bands and small scattered areas associated with the Collington fine sandy loam.

Where the type occurs as narrow belts in better arable soils it is tilled. Along the margins of areas or on stream slopes it is usually left in forest.

Portsmouth sandy loam.—This type is the same as described in the Hartford and Thorofare areas. It occurs only around stream heads where drainage has been partially established. Where drained it is used for growing general farm crops.

Small areas of the Hyde sandy loam, of the Freneau sandy loam, and of fresh-water swamp were also mapped, together with the upland types. They are chiefly or entirely used for pasture and their area is not considered in detail in the discussion of the upland soils and their crop uses.

The total and relative areas of the different upland soils is shown in Table VIII:

TABLE VIII.—*Extent of different soil types, Swedesboro area.*

Soil.	Areas occupied.	Proportion of total occupied area.	Soil.	Areas occupied.	Proportion of total occupied area.
	Acres.	*Per cent.*		*Acres.*	*Per cent.*
Sassafras coarse sandy loam	932.9	37.5	Collington fine sandy loam	127.3	5.1
Sassafras sandy loam	638.4	25.6	Collington fine sandy loam, eroded phase	19.0	.7
Sassafras gravelly coarse sandy loam	119.7	4.8	Collington gravelly sandy loam	22.8	.9
Sassafras coarse sand	117.8	4.8	Portsmouth sandy loam	96.9	3.9
Sassafras fine sandy loam	13.3	.5			
Sassafras loam	3.8	.2			
Colts Neck loamy sand	319.2	12.8	Total	2,490.9	100.0
Colts Neck gravelly sandy loam	79.8	3.2			

It will be observed that while there is a considerable variety both in the origin and in the texture of the different soils as mapped, yet the area as a whole is dominated by sandy and sandy loam soils, and that the soils of the Sassafras series are of the greatest importance, two types of that series comprising 63.1 per cent of the total area mapped. The Colts Neck loamy sand and the Collington fine sandy loam are the only types of any extent which do not fall within the limits of the Sassafras series. Nearly 76 per cent of the total area

is covered by three types. These are the Sassafras coarse sandy loam, 37.5 per cent; the Sassafras sandy loam, 25.6 per cent; and the Colts Neck loamy sand, 12.8 per cent.

USES OF SOILS.

The table showing the extent of the different soil types gives an indication of the prevalently sandy nature of the soils included in the Swedesboro area. Table IX, giving crop acreages, reflects the nature of the soils, since it shows that 52.6 per cent of the total area of occupied land is given to the growing of truck crops, while only 37.1 per cent is utilized for the general farm crops.

TABLE IX.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Swedesboro area.*

Crop group and crop.	All types.		Sassafras coarse sandy loam.		Sassafras sandy loam.		Colts Neck loamy sand.		Collington fine sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	923.4	37.1	342.0	36.6	275.5	43.2	89.3	28.0	34.2	26.9
Corn	385.7	15.5	123.5	13.2	127.3	20.0	32.3	10.1	22.8	17.9
Hay	264.1	10.6	123.5	13.2	83.6	13.1	26.6	8.3	1.9	1.5
Alfalfa	45.6	1.8	15.2	1.6	15.2	2.4	3.8	1.2	1.9	1.5
Pasture	138.7	5.6	41.8	4.5	32.3	5.0	.....	.....	7.6	6.0
Rye	41.8	1.7	26.6	2.9	5.7	.9	7.6	2.4	.....	.....
Cowpeas	36.1	1.4	1.9	.....	11.4	1.8	17.1	5.4	.....	.....
Wheat	7.6	.3	7.6	.8	.....	.....	.....	.....	.....	.....
Oats	3.8	.2	1.9	.....	.....	.....	1.9	.6	.....	.....
Truck crops	1,311.0	52.6	499.7	53.5	304.0	47.6	207.1	65.0	76.0	59.8
Sweet potatoes	560.5	22.5	205.2	22.0	155.8	24.4	79.8	25.0	30.4	23.9
Tomatoes	364.8	14.7	121.6	13.0	89.3	14.0	55.1	17.3	30.4	23.9
Asparagus	191.9	7.7	91.2	9.8	20.9	3.3	53.2	16.7	11.4	9.0
Potatoes	55.1	2.2	19.0	2.0	17.1	2.6	1.9	.6	.....	.....
Cantaloupes	55.1	2.2	34.2	3.7	3.8	.6	7.6	2.4	1.9	1.5
Watermelons	26.6	1.1	7.6	.8	3.8	.6	5.7	1.8	1.9	1.5
Squash and pumpkins	24.7	1.1	1.9	.2	9.5	1.5	1.9	.6	.....	.....
Peppers	15.2	.6	3.8	.4	3.8	.6	.....	.....	.....	.....
Onions	7.6	.3	7.6	.8	.....	.....	.....	.....	.....	.....
Eggplant	5.7	.2	3.8	.4	.....	.....	1.9	.6	.....	.....
Miscellaneous vegetables	3.8	.2	3.8	.4	.....	.....	.....	.....	.....	.....
Fruit crops	102.6	4.1	55.1	6.0	24.7	3.9	9.5	3.0	.....	.....
Orchard	93.1	3.7	45.6	5.0	24.7	3.9	9.5	3.0	.....	.....
Berries	9.5	.4	9.5	1.0	.....	.....	.....	.....	.....	.....
No annual crop	153.9	6.1	36.1	3.9	34.2	5.3	13.3	4.2	17.1	13.4
Garden and grounds	81.7	3.2	22.8	2.5	26.6	4.1	7.6	2.4	11.4	9.0
Forest	41.8	1.7	7.6	.8	5.7	.9	1.9	.6	.....	.....
Nocrop	30.4	1.2	5.7	.6	1.9	.3	3.8	1.2	5.7	4.4
Grand total	2,490.9	100.1	932.9	100.0	638.4	100.0	319.2	100.0	127.3	100.0

Hyde sandy loam (in pasture and hay), 7.6 acres.
Freneau loam (chiefly in pasture), 79.8 acres.
Rough broken land (chiefly in forest), 57 acres.

TABLE IX.—*Proportion of total area and of the area of each soil type occupied by various crops and groups of crops, Swedesboro area*—Continued.

Crop group and crop.	Sassafras gravelly coarse sandy loam.		Sassafras coarse sand.		Portsmouth sandy loam.		Colts Neck gravelly sandy loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	43.7	36.4	36.1	30.6	55.1	56.1	32.3	40.3
Corn	24.7	20.6	17.1	14.5	11.4	11.7	20.9	26.1
Hay	7.6	6.3	13.3	11.3	3.8	3.9	3.8	4.7
Alfalfa	1.9	1.6	5.7	4.8	.....	.....	1.9	2.4
Pasture	7.6	6.3	.....	.....	39.9	41.1	.....	.....
Rye	.....	.....	.....	.....	.....	.....	1.9	2.4
Cowpeas	1.9	1.6	.....	.....	.....	.....	3.8	4.7
Truck crops	66.5	55.4	77.9	66.0	19.0	19.5	22.8	28.5
Sweet potatoes	32.3	26.9	38.0	32.0	1.9	2.0	11.4	14.3
Tomatoes	19.0	15.8	20.9	17.8	5.7	5.8	3.8	4.7
Asparagus	3.8	3.2	9.5	8.0	.....	.....	1.9	2.4
Potatoes	3.8	3.2	.....	.....	5.7	5.8	.....	.....
Cantaloupes	1.9	1.6	3.8	3.2	.....	.....	1.9	2.4
Watermelons	.....	.....	.....	.....	.....	.....	3.8	4.7
Squash and pumpkins	5.7	4.7	3.8	3.2	1.9	2.0	.....	.....
Peppers	.....	.....	1.9	1.6	3.8	3.9	.....	.....
Fruit crops	1.9	1.6	1.9	1.6	1.9	2.0	7.6	9.5
Orchard	1.9	1.6	1.9	1.6	1.9	2.0	7.6	9.5
No annual crop	7.6	6.4	1.9	1.6	20.9	21.6	17.1	21.4
Garden and grounds	3.8	3.2	1.9	1.6	1.9	2.0	1.9	2.4
Forest	.....	.....	.....	.....	15.2	15.7	11.4	14.3
No crop	3.8	3.2	.....	.....	3.8	3.9	3.8	4.7
Grand total	119.7	99.8	117.8	99.8	96.9	99.8	79.8	99.7

Crop group and crop.	Collington gravelly sandy loam.		Collington fine sandy loam (eroded phase).		Sassafras fine sandy loam.		Sassafras loam.	
	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
General farm crops	3.8	16.7	7.6	40.0	.....	.....	3.8	100.0
Corn	.....	.....	5.7	30.0	.....	.....	.....	.....
Pasture	3.8	16.7	1.9	10.0	.....	.....	3.8	100.0
Truck crops	15.2	66.7	11.4	60.0	11.4	85.7	.....	.....
Sweet potatoes	1.9	8.3	3.8	20.0	.....	.....	.....	.....
Tomatoes	9.5	41.7	3.8	20.0	5.7	42.9	.....	.....
Potatoes	3.8	16.7	.....	.....	3.8	28.5	.....	.....
Watermelons	.....	.....	3.8	20.0	.....	.....	.....	.....
Peppers	.....	.....	.....	.....	1.9	14.3	.....	.....
No annual crop	3.8	16.6	.....	.....	1.9	14.3	.....	.....
Garden and grounds	1.9	8.3	.....	.....	1.9	14.3	.....	.....
No crop	1.9	8.3	.....	.....	.....	.....	.....	.....
Grand total	22.8	100.0	19.0	100.0	13.3	100.0	3.8	100.0

With reference to specific crops, sweet potatoes lead all other crops in acreage, followed in order of extent by corn, tomatoes, and hay. The large acreage of pasture arises from the fact that mowing lands are grazed in rotation in this area before being plowed for the growing of a tilled crop. Asparagus ranks next to these crops in acreage, while the other truck crops are found in subordinate though important acreages.

As in the Thorofare area, the Irish potato crop is decidedly of minor importance upon the sandy soils.

It is probable that the grain crops would have been recorded in considerably greater area if the survey had been made earlier in the year, since rye is very commonly grown as a winter cover crop, either to be turned under as a green manure or to be cut as a forage crop. In general the small grains are neither suited to production upon the soils of this locality nor able to compete in acreage value with the truck crops, corn, or alfalfa, so that the area of the more sandy soils devoted to them is small.

The section immediately around Swedesboro furnishes a sharp contrast in this respect to the soils in the vicinity of Woodstown. In that locality the Sassafras loam and sandy loam predominate and

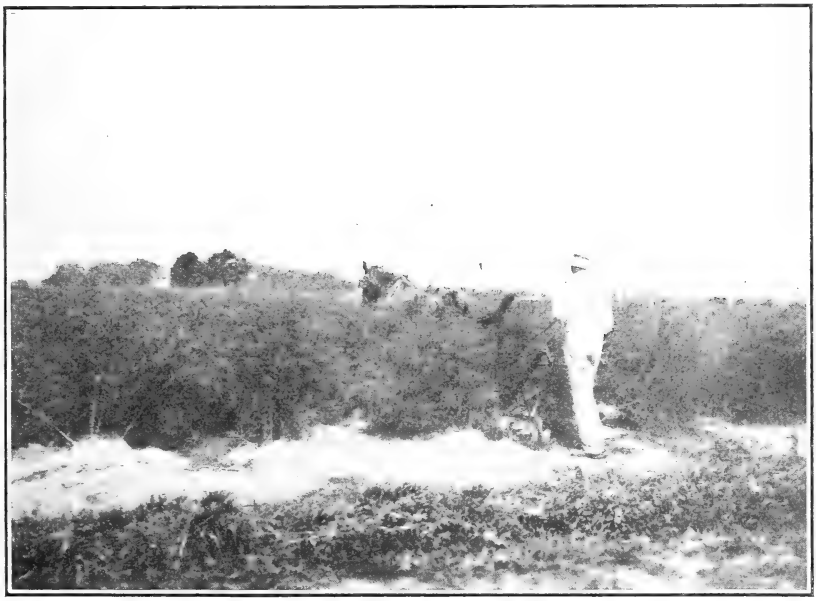


FIG. 27.—Cultivating asparagus on the Sassafras coarse sandy loam, near Swedesboro, N. J.

the small grains, chiefly wheat, are extensively and profitably grown. The influence of the soil upon the character of cropping is clear.

The Sassafras coarse sandy loam dominates the area, forming 37.5 per cent of the acreage tabulated. In consequence the crop occupation of this type does not differ materially from that shown by the percentages for the entire area. The wide use of this soil for growing a variety of truck crops is demonstrated by the fact that 10 different crops are encountered on the type and that truck crops occupy 53.5 per cent of its entire cropped area. A slight preference for this type for asparagus culture is shown. (Fig. 27.) The desirability of this soil for truck-crop production is well shown by the fact that more than 96 per cent of its area is used for some form of cropping, while truck crops occupy a greater area than all other

forms of use. The other general farm crops are grown in well-balanced rotation with them.

The Sassafras sandy loam is the only type of any extent upon which the general farm crops occur in area greater than the standard for all types. Even on this type the truck crops exceed the general farm crops in importance. As in the Thorofare area it is evident that this type is suited to a wide range of crop uses. The fact that a relatively small acreage of asparagus is grown on the Sassafras sandy loam should also be observed. The deeper sandy soils are preferred for that crop as at Thorofare.

The Colts Neck loamy sandy is third in area of the types mapped. Its use for truck crops is distinct, since they occupy 65 per cent of its area. The local preference for this soil for sweet potato growing is also well indicated by the map, 25 per cent of its area being given to that crop. It is also an important soil for growing asparagus and tomatoes.

The Collington fine sandy loam occupies but 5 per cent of the total area of the survey, but is very thoroughly brought under cultivation. Sweet potatoes, tomatoes, and asparagus are the chief truck crops grown upon it, while corn is the only important general farm crop.

The other soil types mapped in the Swedesboro area are relatively of unimportant extent. It is seen that the more sandy soils are chiefly utilized for truck-crop production, while those of heavier texture or those whose natural drainage conditions are not good are chiefly occupied by general farm crops, and that in some instances forest and pasture land dominate. It should be stated that the small area mapped as Sassafras loam is scarcely typical, since it occurs in two small depressions where loamy wash from the upland soils has accumulated. It is only used for pasture and for hay growing.

The facts shown by the Swedesboro map will justify the assertion that the presence of suitable sandy or sandy loam soils, even at some distance from city markets, results in southern New Jersey in the adoption of farm practices which strongly tend toward truck-crop production.

COMPARISON OF THE DETAILED AREAS.

The four areas for which these detailed soil and crop maps were made were selected primarily to secure a representative condition of cropping for each of the more extensive and important soils found in southern New Jersey. It was also found to be possible to locate them in such a manner that contrasts between important soil types and their influence upon cropping and agricultural practice were possible. Thus, the Freehold and Sweedesboro areas may easily be contrasted and the Hartford and Thorofare areas form a couple well suited to the study of the influence of soil upon crop practices.

FREEHOLD AND SWEDESBORO AREAS CONTRASTED.

The Freehold and Swedesboro areas show sharp contrasts in cropping. The two areas illustrate the extremes in development which may be attained in this region as a result of the selection of specific crops suitable to different soils.

The areas included in the two surveys are very nearly the equal in extent. The Freehold area comprises 2,507.1 acres of crops, the Sweedesboro area 2,490.9 acres.

In the Freehold area 93.2 per cent of the area is made up of loam soils or heavier. The Sassafras loam alone occupies 83.7 per cent of the total. In the Swedesboro area practically the entire extent of the area is made up of sandy loam and sandy soils.

In the Freehold area the general farm crops occupy 50.7 of the total area and Irish potatoes cover 39.7 per cent. In the Swedesboro area truck crops cover 52.6 per cent of the area, while the general farm crops drop to 37.1 per cent. The areas in fruit crops are nearly the same for the two areas. The area not planted to crops is slightly higher in the Swedesboro area but in both areas it is practically negligible.

Irish potatoes lead all other crops in acreage in the Freehold area. They are the chief cash crop and they are the special crop most successfully grown on a loamy soil. Moreover, it is known that the dominant soil of the area, the Sassafras loam, is there and elsewhere the preferred potato soil of all New Jersey.

In the Swedesboro area, sweet potatoes occupy the greatest acreage, covering 22.5 per cent of all cropped land. They are grown on the more sandy soils to an extent somewhat greater than upon the sandy loams of that area. Corn is second in importance and then tomatoes follow with a relative extent of 14.7 per cent of the area. In all, 13 truck crops are grown to some extent. Practically no small grains are grown except as cover crops.

The Freehold area is located a little farther from the New York market than Swedesboro is from the Philadelphia market. In both cases access to either market is easy. In both cases a large part of the special crops grown is marketed in other localities than these two cities.

Consequently, the differences in cropping that have been shown to exist in these two cases must be ascribed to the demonstrated differences in soil conditions, possibly modified to a slight degree by the traditions of agriculture in the two localities.

Stated more specifically, the loam soils of the area around Freehold are naturally better adapted to the growing of corn, hay, small grains, and Irish potatoes than to any other products of the soil suited to the prevailing climate. The sandy loam and sandy soils of the area around Swedesboro are inherently better suited to the produc-

tion of special truck crops, especially sweet potatoes, tomatoes, cantaloupes, asparagus, watermelons, and peppers, than to the production of the majority of general farm crops. Corn and hay may be grown in a supplementary way, and several of the sandy loam types are inherently suited to corn growing. Other types, not so well adapted to general farming under normal conditions have been so well supplied with organic manures in the form of green cover crops plowed under and also stable manure, generously applied, that they are capable of growing corn crops far above their normal capacity.

Both of these areas are representative of considerable regions in southern New Jersey and, so far as reconnoissance observations could be depended upon, they were but intensified illustrations of what may be accomplished upon the same soils wherever they occur in the general region.

HARTFORD AND THOROFARE AREAS CONTRASTED.

Certain contrasts between the Hartford and Thorofare areas have been drawn in part.

In the Hartford area the dominant soils are the Sassafras loam and sandy loam, covering 70.8 per cent of the tilled area. Their occupation by crops is comparable to that of the Freehold area, although differing somewhat in detail. The area as a whole supports 42.0 per cent of general farm crops and 31.2 per cent of truck crops, of which 18 per cent is credited to Irish potatoes. Other truck crops, aside from tomatoes and cabbage, both of which are suited to loam and sandy loam soils, are decidedly unimportant, although the other soils of the area are capable of truck-crop occupation.

In the Thorofare area 69.3 per cent is occupied by the Sassafras sand. The Sassafras sandy loam is the most retentive soil found within the limits of the survey. It occupies 18.3 per cent of the cropped area. The truck crops not only cover 62.9 per cent of the occupied land of the Thorofare area, but four of them—asparagus, sweet potatoes, tomatoes, and cantaloupes—lead all other crops in acreage, ranking in extent in the order named. The acreage planted to asparagus nearly equals that given to the combined area of corn and hay.

Such facts mark the Thorofare area as one of the most highly specialized trucking areas in southern New Jersey. This specialization has been made possible by the existence there of the Sassafras sand.

The general facts shown by the comparison of the Hartford and Thorofare areas are: (1) The areas are equally well situated with respect to climate, markets, and transportation. (2) Loam and sandy loam soils dominate the Hartford area and general farm crops are there more extensively grown than truck crops. Among the latter, potatoes and tomatoes are by far the most important. (3) Sand

and sandy loam soils dominate the Thorofare area. The preponderance of truck crops over general farm crops is marked and four truck crops lead any general farm crop in acreage. Even Irish potatoes are a negligible crop on the Sassafras sand, the chief acreage being grown on the sandy loam.

The conclusion to be drawn is that sandy soils are best suited to the production of truck crops. They are not well suited to the profitable production of general farm crops. These facts are well known in southern New Jersey and the farm practices of the region have become adjusted to them.

Again the differences in cropping which have been shown to exist may be exactly correlated with the differences in the properties of the prevailing soils.

RELATION OF SOILS TO CROP USES IN THE DETAILED AREAS.

The four areas of which detailed soil and crop maps were made in 1914 and 1915 in southern New Jersey show a total measured area of 8,848.5 acres, while 8,919.6 acres of different classes of occupation were recorded. This over-run of occupation above total acreage is due to the fact that interplanting of crops is a common practice in three of the areas. The most notable instances are those in which berries, corn, or truck crops are planted between the rows of orchard trees. There are also many notable instances in which the various truck crops are interplanted. Chief among these are the growing of an early crop of peas with such spacing that tomatoes may be set between the rows, the interplanting of beans or peas between the rows in young asparagus beds, the planting of tomatoes between the rows of young strawberry beds, and the growing of a rapid succession of minor vegetables to aid in making up a varied load of produce on the market wagon.

Naturally, such practices are more evident where intensive trucking prevails and are chiefly to be found in the Thorofare area.

A tabulation of the different soil types encountered in the four soil and crop surveys shows that there are 11 types which are of sufficient extent to be considered dominant soils. There are also 10 other types which are of minor extent. These 21 different types, therefore, are separated into two main groups, the dominant soils, which exert an appreciable influence upon the agriculture of the areas, and the subordinate soils, which are of little agricultural importance within the limits of these surveys.

The dominant soils are arranged into three subgroups. Those soils which are marked by complete surface and internal drainage to such a degree as to tend toward a droughty condition are classed in the sand and coarse sandy loam group. Those which are decidedly retentive of moisture, either through circumstances of texture or

because of topographic position, are grouped in the loam and sandy loam group. One type is intermediate in texture and water-holding capacity, and this forms the fine sandy loam group.

The relationships of the dominant and of the subordinate soils to crop production and the relationships of the three groups to each other are shown in Table X:

TABLE X.—*Proportion of total area and of the area of each type occupied by various crops and groups of crops in the four detailed areas.*

DOMINANT SOILS.

Soil and soil group.	Total area measured.	Area in crops, etc.	Truck crops.		General farm crops.		Fruit crops.		No annual crops.	
			Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
I. SAND AND COARSE SANDY LOAM GROUP.	*Acres.*	*Acres.*								
Sassafras sand	934.8	940.5	693.5	73.6	81.7	8.7	72.2	7.6	93.1	9.9
Sassafras coarse sand	115.9	117.8	77.9	66.0	36.1	30.6	1.9	1.6	1.9	1.6
Colts Neck loamy sand	317.3	319.2	207.1	65.0	89.3	28.0	9.5	3.0	13.3	4.2
Sassafras gravelly coarse sandy loam	117.8	119.7	66.5	55.4	43.7	36.4	1.9	1.6	7.6	6.4
Sassafras coarse sandy loam	908.2	932.9	499.6	53.5	342.0	36.6	55.1	6.0	36.1	3.9
	2,394.0	2,430.1	1,544.6	63.6	592.8	24.4	140.6	5.8	152.0	6.2
II. FINE SANDY LOAM GROUP.										
Collington fine sandy loam	275.5	279.3	144.4	51.7	70.3	25.1	30.4	10.9	34.2	12.3
	275.5	279.3	144.4	51.7	70.3	25.1	30.4	10.9	34.2	12.3
III. LOAM AND SANDY LOAM GROUP.										
Sassafras loam	3,024.5	3,041.2	1,235.6	40.6	1,523.9	50.1	146.6	4.8	135.1	4.4
Portsmouth sandy loam	245.1	250.8	79.8	31.8	115.9	46.5	13.3	5.3	41.8	16.7
Sassafras sandy loam	1,487.4	1,510.1	605.4	40.1	646.1	42.7	120.2	8.0	138.4	9.2
Colts Neck gravelly sandy loam	77.9	79.8	22.8	28.5	32.3	40.3	7.6	9.5	17.1	21.4
Collington sandy loam (deep phase)	108.3	115.9	34.2	29.6	45.6	39.3	30.4	26.2	5.7	4.9
	4,943.2	4,997.8	1,977.8	39.6	2,363.8	47.3	318.1	6.4	338.1	6.7

SUBORDINATE SOILS.

IV. ALL TEXTURES.[1]										
Collington sand	281.2	283.1	17.1	6.0	60.8	21.9	20.9	7.4	184.3	64.8
Colts Neck sandy loam	65.9	65.7	13.1	20.0	47.0	71.5	1.6	2.5	4.0	6.0
Collington sandy loam	53.3	55.9	12.7	22.8	24.2	43.3	17.1	30.2	1.9	3.4
Sassafras fine sandy loam	13.3	13.3	11.4	87.5	.....	.....	.....	.....	1.9	14.3
Collington fine sandy loam (eroded phase)	19.0	19.0	11.4	60.0	7.6	40.0	.....	.....	.....	.....
Colts Neck loam	68.5	68.2	12.2	18.0	52.4	76.8	.....	.....	3.6	5.2
Collington loam	46.1	42.4	32.0	75.5	9.4	22.1	1.0	2.3	.....	.....
Elkton loam	30.4	30.4	9.5	31.3	17.1	56.3	3.8	12.5	.....	.....
Collington clay loam	15.4	15.3	5.6	36.6	4.1	26.8	5.6	36.6	.....	.....
Collington gravelly sandy loam	22.8	22.8	15.2	66.7	3.8	16.7	.....	.....	3.8	16.6
	615.9	616.1	140.2	22.8	226.4	36.8	50.0	8.1	199.5	32.3

SUMMARY.

I. Sand and coarse sandy loam group	2,394.0	2,430.1	1,544.6	63.6	592.8	24.4	140.6	5.8	152.0	6.2
II. Fine sandy loam group	275.5	279.3	144.4	51.7	70.3	25.1	30.4	10.9	34.2	12.3
III. Loam and sandy loam group	4,943.2	4,997.8	1,977.8	39.6	2,363.8	47.3	318.1	6.4	338.1	6.7
IV. Subordinate soils, all textures	615.9	616.1	140.2	22.8	226.4	36.8	50.0	8.1	199.5	32.3
All types, four detailed areas	8,228.6	8,323.3	3,807.0	45.7	3,253.3	39.1	539.1	6.5	723.8	8.7

[1] Freneau loam, of Freehold area, omitted

In this table the total measured area of each type, the area occupied for different purposes connected with agriculture, and the areas and percentages of the different classes of occupation are summarized from the detailed tables given in the presentation of the facts concerning each of the four areas. The same classification of crops is made as in the detailed tables.

The final classification of all soil and crop areas mapped is shown in the summary given in this table.

The notable facts derived from this tabulation may be briefly stated.

With respect to the soils of the sand and coarse sandy loam group, it is shown that truck crops are of chief importance, covering 63.6 per cent of the total cropped area. General farm crops cover only 24.4 per cent, while orchard and other fruit crops cover 5.8 per cent. Only 6.2 per cent of the group is not occupied for the growing of these crops.

In contrast, the soils of the loam and sandy loam group have only 39.6 per cent of their area in truck crops, including Irish potatoes in this class, while 47.3 per cent is in general farm crops and 6.4 per cent in fruit crops. The area not cropped is again small, comprising only 6.7 per cent of the total.

The fine sandy loam group is intermediate between the two other groups, carrying 51.7 per cent of truck crops and 25.1 per cent of general farm crops, but showing 10.9 per cent of fruit crops and 12.3 per cent of area not occupied by annual or orchard crops.

The preferred uses of the different types are capable of a degree of mathematical approximation through a comparison of the relative areas of each crop and group of crops supported by the different soil types. Thus, for truck-crop production the Sassafras sand takes leading rank, with 73.6 per cent of its area occupied by such crops. The other soils of this group are arranged under this type in the order of their relative importance in truck-crop production. The lowest percentages of truck crops found on any soil in the group is 53.5 per cent. It is notable that the three sandy soils in the group considerably outrank the two coarse sandy loams in percentage of truck-crop maintenance This is almost sufficient to justify a subgrouping within the group.

Within the loam and sandy loam group the highest percentages given to any class of truck crops is found on the Sassafras loam with 40.6 per cent of its area given to such crops. This is almost equalled by the Sassafras sandy loam, with 40.1 per cent of the truck crops. In both of these cases the high percentage must be ascribed to the large areas of Irish potatoes grown upon the two types. The growing of other truck crops than potatoes and tomatoes on either of these soils is negligible.

The soils of this group were not arranged, however, with respect to their utilization for truck-crop production, since that is a matter which is of secondary importance in their case. The arrangement is made on the basis of the percentage of their areas given to general farm crops. The Portsmouth sandy loam takes second rank, not so much because of its texture as because of its low-lying topographic position. It is so situated as to be permanently moist and this gives rise to its use for the growing of hay and corn to a degree exceeding what might be expected from its sandy texture.

Without reference to the absolute figures, it should be noted that each type in this group supports a higher percentage of general farm crops than of truck crops.

The single type in the fine sandy loam group is hardly sufficient to form a basis for any decided conclusions beyond the fact that it falls between the extremes set by the sandy soils on the one hand and the more loamy soils on the other.

No very definite conclusions with respect to the crop occupation of the subordinate soils should be drawn from the figures given. It is evident, however, that the Collington sand is found to be too porous and droughty for any large amount of farm occupation. The use of the Collington loam and sandy loam and the Elkton loam for the growing of general farm crops and potatoes is in accord with the general conditions observed over considerable areas of these types included in the reconnoissance work in southern New Jersey.

It is apparent from these tables that soils may be classed according to their textural peculiarities in rather close accord with the fact of crop occupation within an area of well developed and specialized farming such as that of southern New Jersey.

The table shows that the balance between general farming and truck-crop production within these four areas is a graduated matter of soil-texture control. The truck crops dominate the sandy soils, and the general farm crops dominate the loamy soils. There is a fairly definite graduation in the crop occupation of the types from the sandy soils, through the coarser sandy loams and the heavier sandy loams, to the loams at the other end of the scale. The consonance between texture and crop uses is too close through the entire set of dominant soils to be considered as any mere matter of accidental coincidence. Moreover, the four areas are too widely separated geographically to permit one to attribute this consonance to the possible influence of prejudice in soil selection for crop growing as might be the case in a single community more or less wedded to a traditional system of agriculture.

The practical application of the soil-survey classification of soils to the needs of progressive agriculture with respect to the selection

of specific crops for definite soils is held to be proved through the results of these surveys of both soils and crops.

RELATIONSHIP BETWEEN SPECIAL CROPS AND DEFINITE SOIL TYPES.

The figures of crop acreages have been tabulated to show the kinds of soils actually used for each of the special crops extensively grown in the territory.

Sufficient areas of potatoes, sweet potatoes, tomatoes, asparagus, and cantaloupes were mapped on the different soils to form a basis for conclusions to be drawn regarding these crops. These constitute by far the most important truck crops grown in southern New Jersey.

These crops and their soil relationships are summarized in Tables XI and XII:

TABLE XI.—*Relation of soils and groups of soils to important special crops, summarized from the tables covering the four detailed areas.*

Type and group.	Total area in crops, etc.	Potatoes.		Sweet potatoes.		Tomatoes.		Asparagus.		Cantaloupes.	
		Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
I. SAND AND COARSE SANDY LOAM GROUP.	*Acres.*										
Sassafras sand	940.5	1.9	0.0	153.9	16.4	104.5	11.1	191.9	20.4	93.1	9.9
Sassafras coarse sand	117.8	.0	.0	38.0	34.0	20.9	17.7	9.5	8.0	3.8	3.4
Colts Neck loamy sand	319.2	1.9	.6	79.8	25.0	55.1	17.3	53.2	16.4	7.6	2.4
Sassafras gravelly coarse sandy loam	119.7	3.8	3.1	32.3	26.9	19.0	15.8	3.8	3.1	1.9	1.6
Sassafras coarse sandy loam	932.9	19.0	.2	205.2	22.0	121.6	13.0	91.2	9.8	34.2	3.7
The group	2,430.1	26.6	1.1	509.2	20.9	321.1	13.2	349.6	14.4	140.6	5.8
II. FINE SANDY LOAM GROUP.											
Collington fine sandy loam	279.3	24.7	8.5	30.4	10.8	51.3	18.3	11.4	4.1	7.6	2.7
The group	279.3	24.7	8.5	30.4	10.8	51.3	18.3	11.4	4.1	7.6	2.7
III. LOAM AND SANDY LOAM GROUP.											
Collington sandy loam, deep phase	115.9	3.8	3.2	0.0	0.0	11.4	10.0	5.7	5.0	0.0	0.0
Colts Neck gravelly sandy loam	79.8	.0	.0	11.4	14.3	3.8	4.8	1.9	2.4	1.9	2.4
Sassafras sandy loam	1,510.1	200.7	13.3	163.4	10.8	171.0	11.3	32.3	2.1	15.2	1.0
Portsmouth sandy loam	250.8	22.8	9.1	5.7	2.0	15.2	6.0	1.9	.7	.0	.0
Sassafras loam	3,041.2	1,103.6	36.3	.0	.0	60.8	2.0	9.5	.3	.0	.0
The group	4,997.8	1,330.9	26.6	180.5	3.6	262.2	5.2	51.3	1.0	17.1	.3
All dominant soils	7,707.2	1,383.2	17.9	720.1	9.3	634.6	8.2	412.3	5.4	165.3	2.2

TABLE XII.—*Relation of soils and groups of soils to certain secondary special crops, summarized from the table covering the four detailed areas.*

Type and group.	Total area in crops, etc.	Cabbage.		Watermelons.		Peppers.		Beans.		Eggplant.		Onions.	
		Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.	Acres.	Per cent.
I. SAND AND COARSE SANDY LOAM GROUP.													
Sassafras sand	940.5	1.9	0.0	24.7	2.6	26.6	2.8	19.0	2.0	26.6	2.8	19.0	2.0
Sassafras coarse sand	117.8	.0	.0	.0	.0	1.9	1.7	.0	.0	.0	.0	.0	.0
Colts Neck loamy sand	319.2	.0	.0	5.7	1.8	.0	.0	.0	.0	1.9	.6	.0	.0
Sassafras gravelly coarse sand	119.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Sassafras coarse sandy loam	932.9	.0	.0	7.6	.8	3.8	.4	1.9	.2	3.8	.4	7.6	.0
The group	2,430.1	1.9	.0	38.0	1.5	32.3	1.3	20.9	.8	32.3	1.3	26.6	1.1
II. FINE SANDY LOAM GROUP.													
Collington fine sandy loam	279.3	13.3	4.7	1.9	0.7	0.0	0.0	0.0	0.0	0.0	.0	3.8	1.4
The group	279.3	13.3	4.7	1.9	.7	.0	.0	.0	.0	.0	.0	3.8	1.4
III. LOAM AND SANDY LOAM GROUP.													
Collington sandy loam, deep phase	115.9	0.0	0.0	0.0	0.0	0.0	0.0	3.8	3.2	0.0	0.0	0.0	0.0
Colts Neck gravelly sandy loam	79.8	.0	.0	3.8	4.8	.0	.0	.0	.0	.0	.0	.0	.0
Sassafras sandy loam	1,510.1	1.9	.1	3.8	.2	5.7	.4	.0	.0	1.9	.1	.0	.0
Portsmouth sandy loam	250.8	9.5	3.4	.0	.0	3.8	1.5	1.9	.9	1.9	.8	1.9	.8
Sassafras loam	3,041.2	31.1	1.0	.0	.0	.0	.0	11.4	.4	.0	.0	.0	.0
The group	4,997.8	42.5	.9	7.6	.1	9.5	.1	17.1	.3	3.8	.0	1.9	.0
All dominant soils	7,707.2	57.7	0.7	47.5	0.6	41.8	0.5	38.0	0.5	36.1	0.5	32.3	0.4

The data concerning each crop will be summarized separately.

Irish potatoes.—The figures given in Tables XI and XII show that the Sassafras loam leads all other soils in the absolute acreage of Irish potatoes grown as well as in the relative importance of the crop upon that type. Out of a total acreage of 3,041.2 acres of this type, included in the four detailed surveys, 1,103.6 acres, or 36.3 per cent of the type, was found to be used for Irish potatoes. No other soil included in the surveys approached this in importance in potato growing. The Sassafras sandy loam was second in rank as a potato soil, carrying 200.7 acres in this crop. The relative and absolute importance of potatoes on all other soil types is negligible.

These figures merely give mathematical substantiation of the statements made by Jennings, Patrick, and others that "the Sassafras loam is the preferred soil for the production of Irish potatoes in southern New Jersey."

Sweet potatoes.—All of the soils of the sand and coarse sandy loam group are extensively utilized for sweet potatoes. The Sassafras coarse sand carries the largest percentage of area among soils suited to this crop. Among the sandy loam soils, only the Colts Neck gravelly sandy loam and the Sassafras sandy loam produced any large area or percentage of the crop. These facts are in strict accord with the generally known preference of farmers for a sandy or deep sandy loam soil for the growing of this crop. Not a single acre of sweet potatoes was encountered on the entire extent of 3,041 acres of the Sassafras loam.

Tomatoes.—The soils of the sand and coarse sandy loam group lead in the acreage given to tomatoes, although the loam group is well represented. Compared with its total extent, the Collington fine sandy loam bears a large acreage of tomatoes. It carries 51.3 acres, or 18.3 per cent of its area, in this crop. The Sassafras sandy loam supports the largest absolute acreage in tomatoes, but has only 11.3 per cent of its area in the crop. The Sassafras coarse sandy loam and the Sassafras sand are also important in the growing of tomatoes. They occupy 13 per cent of the area of the former and 11.1 per cent of the latter soil.

Since tomatoes are grown both for direct marketing and for canning, ripening at two distinct periods, there is a wide range in the character of the soils upon which the crop may be grown to advantage. Prevalently sandy and sandy loam soils are chosen for the early and medium early crops, while the more loamy soils are chiefly used for the canning crop.

Asparagus.—The Sassafras sand is the leading type in the growing of asparagus. The type bears 191.9 acres of asparagus, or 20.4 per cent of its total area. The Sassafras coarse sandy loam carried 91.2 acres, or 9.8 per cent of its tilled area, while the Colts Neck

loamy sand bears 53.2 acres, or 16.4 per cent of its area in this crop. All three types are decidedly sandy to a depth of 2 feet or more. All three are underlain at a depth ranging from 30 inches to 4 feet by more retentive layers. None of the gravelly soils is used to any extent for this crop.

Cantaloupes.—Cantaloupes are of less importance than the foregoing crops, but are still grown to quite an extent in southern New Jersey.

The Sassafras sand leads in acreage, carrying 93.1 acres, or 9.9 per cent of its area, in cantaloupes. The Sassafras coarse sandy loam is the only other type upon which cantaloupes are important.

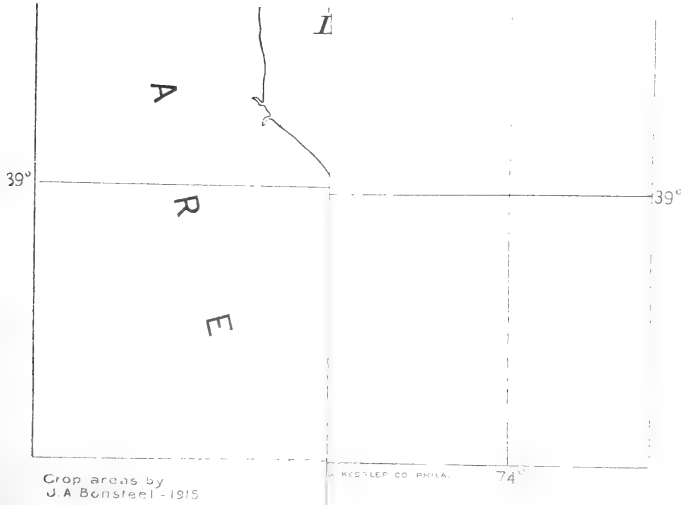
The truck crops of secondary importance show some interesting soil relationships.

Cabbage.—The crop maps show a total acreage of 57.7 acres in the four areas. The Sassafras loam leads in cabbage production, with 31.1 acres, and the Collington fine sandy loam is second, with 13.3 acres. These two soils are the only important cabbage soils represented. It is known that soils of the Keansburg series are quite extensively used for growing the crop. It may easily be seen that the heavier loams are preferred for cabbage production. The most notable exception, not shown in the tables, would be that sandy loam soils in a moist position are also chosen for cabbage growing.

Watermelons.—Melons are now grown to a limited extent in the southern New Jersey trucking regions, although formerly the crop was of considerable importance. Only 47.5 acres were encountered in the four detailed surveys. Over one-half of this total occurred on the Sassafras sand, which carried 24.7 acres, or 2.6 per cent of its area, in this crop. All other occurrences of the crop are of minor importance.

Peppers.—The pepper crop is of considerable importance in other sections of southern New Jersey, but only a small area fell within the limits of the detailed surveys. Considerably over one-half of the total acreage in peppers occurs on the Sassafras sand. The other areas are scattering.

Beans.—Two types lead in the production of beans. These are strongly contrasted in texture. The Sassafras sand carried 19 acres and the Sassafras loam, 11.4 acres, or a total of 38 acres in beans. It is known that if the surveys had been made at a slightly earlier period of the season added areas of beans would have been mapped. The significance of the present figures is, therefore, small. The production of lima beans for canning has already been noted as an exceptional cropping practice on the Sassafras loam near Freehold.



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U S. DEPT OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F MARBUT IN CHARGE SOIL SURVEY

GENERALIZED CROP MAP

PLATE B

SOUTHERN NEW JERSEY

75°
74°
40°
39°

PENN.
DELAWARE
DELAWARE RIVER
DELAWARE BAY
ATLANTIC OCEAN
FOREST

Keyport
Redbank
FREEHOLD
Long Branch
Asbury Park
Manasquan
TRENTON
Burlington
MT. HOLLY
Hartford
Moorestown
CAMDEN
Whiting
WOODBURY
Swedesboro
Mullica Hill
Pennsgrove
Glassboro
Woodstown
Elmer
SALEM
Hammonton
Vineland
MAYS LANDING
BRIDGETON
Millville
Atlantic City
Cape May

TRUCK
FRUIT
ASPARAGUS
RURAL ESTATES
HAY
CORN
WHEAT
POTATOES
POTATOES (AM. GIANT)
LIMA BEANS
MARKET GARDENING
POTATOES (COBBLERS)
TOMATOES
BERRIES
CABBAGE
SWEETS
CUCUMBERS
CANTALOUPE
PEPPERS
BEANS
SWEET POTATOES
PEACHES
GRAPES
TOMATO CANNING CROPS
TRUCK-CANNING CROPS
TRUCK-BERRIES
MARKET GARDEN BERRIES
MARKET GARDENING VEGETABLES
FRUIT GARDENING
POULTRY

Crop areas by
J A Bonsteel 1915

10 0 10 20 30 Miles

Eggplant.—Nearly the entire acreage of this crop was found on the Sassafras sand, 26.6 acres out of a total of 36.1 acres being mapped on this type.

Onions.—Nineteen out of a total of 32.3 acres of onions were mapped on the Sassafras sand. The Sassafras coarse sandy loam carries the next largest area, 7.6 acres.

SUMMARY OF SELECTIVE USES AS SHOWN BY THE MAPS.

The selective uses of soils in southern New Jersey, as illustrated by these detailed maps, may be briefly summarized:

(1) For the production of Irish potatoes, the Sassafras loam is the soil preferred over all other types and classes. A sandy loam soil, like the Sassafras sandy loam or the Collington sandy loam, may be used, particularly for an early crop. Sandy soils are distinctly avoided.

(2) The sweet potato crop is produced to the best advantage upon sandy soils or upon rather coarse sandy loams. Taking into consideration the quality of the product, the Colts Neck loamy sand is a leading type. If only considerations of yield are taken into account, then the Sassafras coarse sand and coarse sandy loam are the most important soils for growing the crop. The sandy loams of the series may also be used.

(3) Tomatoes are grown for two distinct purposes, market and canning. The early tomatoes are largely grown on the Sassafras sand, coarse sandy loam, and sandy loam. The later crop for canning is grown on the Sassafras loam and upon the Collington fine sandy loam and sandy loam. The latter fact is not brought out by the tables, but appears from a reconnoissance of the general region.

(4) Sandy soils are preferred for asparagus. The Sassafras sand is a leading type in its production. The Colts Neck loamy sand is second in importance.

(5) Cantaloupes are chiefly grown upon the Sassafras sand, with the Sassafras coarse sandy loam also constituting an important type for this crop.

(6) Cabbage is distinctly a crop to be grown upon the finer textured and more retentive soils, such as the Sassafras loam.

(7) The other minor crops were not sufficiently well represented within the limits of the survey to permit of general conclusions.

SOIL PREFERENCES EXPRESSED BY FARMERS.

In order that the various classes of observations made by field men of the United States Department of Agriculture might be compared with the opinions of a number of representative farmers in southern

New Jersey, letters were sent to nearly 4,000 farmers, principally located within the sections where the detailed soil and crop surveys were made, but also distributed to some extent over other sections of the region.

In these letters inquiries were made concerning the individual preference of each farmer for a sand, sandy loam, loam, or "clay" soil for the growing of each of 14 crops. Additional inquiries were included concerning yields, the use of cover crops for green manuring, the use of stable manure, and the amount and formula of the commercial fertilizer commonly used for the more important crops.

Answers were received from about 1,000 persons. The material thus obtained was classified with regard to the preference for particular soils in the growing of each crop.

Table XIII shows, in terms of the percentage of all answers received, the soil class preferred for the various truck crops:

TABLE XIII.—*Number of answers received, and percentage of preference for each soil class for the various truck crops.*

Crop.	Answers received.	Sand.	Sandy loam.	Loam.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Sweet potatoes	245	61	39	.....	.....
Watermelons	151	56	41	3	.....
Asparagus	163	26	62	10	2
Cantaloupes	178	25	63	12	.....
Peas	142	17	62	20	1
Cucumbers	82	10	65	23	2
Eggplant	69	29	45	26	.....
Beans	147	13	60	27	.....
Peppers	114	7	47	44	2
Tomatoes	359	3	49	42	6
Sweet corn	201	3	38	55	4
Onions	96	5	33	57	5
Potatoes	450	.....	34	60	6
Cabbage	187	1	17	71	11

The largest number of answers was received concerning the potato crop. In slightly less than one-half the replies received a definite choice of soil was expressed and 450 decisive answers were tabulated. The answers with respect to tomatoes, sweet potatoes, and sweet corn were also numerous. These four crops lead in acreage among the special crops grown within the territory under consideration.

Some explanation is needed with regard to the soil-texture terms used in connection with these inquiries and answers. In the first place, only soil texture is considered. The classification into soil series is not yet well enough understood nor generally enough used among farmers to permit of more than a broad application to the answers submitted. In the case of the texture of soils the soil survey classification so closely parallels the common usage of farmers that there is little chance for mistake, except where the survey classification goes into greater detail than in the common usage. Hence only four groups were included in the inquiry.

There are only a few unimportant areas of true clay soils in southern New Jersey. The Sassafras loam is the only soil of any great extent within the region which is even popularly known as a clay. This type contrasts rather strongly with the associated sandy soils and has come to be known as a "clay loam" or "clay" in some localities.

It is probable, therefore, that all of the answers designating a preference for a "clay" soil should be added to the loam column to secure exact accuracy.

There is also a local tendency to consider any sandy soil which is not absolutely incoherent as a sandy loam. This is true of many localities where sandy soils prevail. In general, the popular classification of soil textures in this region corresponds fairly well with the more detailed classes used by the soil survey and based upon the physical analyses of the soils.

SOIL PREFERENCES FOR TRUCK CROPS.

The tabulated summary of expressed preferences for the different classes of soil for the growing of truck crops shows that the 14 crops enumerated fall into four rather distinct groups. In making the arrangement, a percentage basis was used in order that the widely differing numbers of answers for the different crops might be equalized. Thus, the percentage of answers expressing a preference for sandy soils for the growing of watermelons is comparable with the percentage of expressed preferences for sandy soil for sweet potato production, although 151 answers were tabulated in the first case and 245 in the latter.

Also, in the first two groups the ranking within the groups is made with respect to the sums of the percentages preferring sand and sandy loam soils, while in the other two groups the ranking is with reference to the sums of the percentages preferring loam or "clay" soils. In both the absolute preferences among the four classes of soils are displayed in detail.

It is evident from this table that the great preponderance of opinion favors the growing of sweet potatoes and watermelons on soils which are distinctly sandy. In the case of sweet potatoes there was no dissent from the preference for soil of these two classes, while the preference for straight-out sand is marked. For watermelons a majority prefer sand.

The second group, including crops for which sandy loam soils are preferred, includes 8 out of the 14 crops for which answers were received. In all cases within this group the sandy loam soils are preferred to any other class, and in three instances—asparagus, cantaloupes, and eggplant—the sandy soil is second to sandy loam in preference. In the other cases, while a sandy loam soil is preferred,

yet a loam soil is the expressed second choice. This is particularly marked in the case of peppers and tomatoes, for which there seems to be little preference between a sandy loam and a loam soil.

In the case of tomatoes the geographic distribution of the several answers served to indicate that the sandy loam soils were preferred where the crop was grown for early harvesting as a market crop, while the loam soil was as distinctly preferred in growing the crop for the canning factories.

In this case the crop is grown for two distinctly separate purposes. The truck-crop grower desires to secure a moderately heavy yield of early varieties which will sell at high prices. The main crop is marketed in crates and some of the later pick is marketed at much smaller prices for canning if the conditions are favorable. The grower of tomatoes as a truck crop depends chiefly on early marketing and a high price. He, therefore, prefers a sandy loam soil.

The grower of tomatoes who contracts his crop to the canning factory sets different varieties from the trucker. His sales are usually made on the ton basis and he decidedly depends upon heavy yields for his chances for profits. He, therefore, desires to use a heavier loam soil. For this reason the Sassafras loam has come to be recognized as the leading soil type for the growing of canning tomatoes, as it has been for the growing of Irish potatoes.

In the case of peppers, the crop is used by many truckers as a supplementary crop only. By them it is planted upon land which was not in condition for planting to early tomatoes, to sweet potatoes, or to some other standard early truck crop. Small areas of low, wet land within a sandy or sandy loam field are frequently planted to peppers long after the remainder of the field has been set out to tomatoes or sweet potatoes. In other cases, where peppers constitute a special crop, grown in large acreage, the crop has been found to produce reasonably early fruits on sandy loam soils and also to continue the picking season up to frost limits, when it is planted upon loams. It is therefore a crop grown quite extensively in some localities which are not fitted by the presence of sandy soil for the growing of the standard truck crops. The Sassafras sandy loam and the Sassafras gravelly sandy loam, in southeastern Gloucester County and in adjacent portions of Atlantic and Cumberland Counties, are quite extensively planted to peppers.

It will be noted that asparagus and cantaloupes stand at the head of the crops for which sandy loam to sandy soils are preferred. There is little difference between them with respect to soil choice. The answers received concerning asparagus were grouped somewhat excessively in the southwestern part of the State, where the production of the unblanched stalks is a specialty. It is possible that a stronger tendency toward the use of a decidedly sandy soil would

have been recorded if a larger number of answers could have been secured from Monmouth County, where the blanched asparagus is quite extensively grown.

The preference for a sandy loam soil for the growing of peas and beans as early truck crops is marked.

The fact that eggplant is grown on a wide range of soils with some preference for sandy loam types is well reflected in the tabulation of the answers. Probably no other crop but peppers is grown on soils varying so widely in texture as eggplant. Both crops are picked during a prolonged season and the trucker's requirements for a special soil for their production is not so marked as in many other cases.

The group for which a straight-out loam soil is preferred only includes three crops. Two of these are among the most important grown in southern New Jersey.

For sweet corn the preference is decidedly for a loam soil, yet enough truckers are growing the crop in connection with the other early truck crops for 38 per cent of all of the answers to express a preference for a sandy loam soil.

For onions, the loamy soils are preferred, yet a considerable numbers of answers chose the sandy loam soil.

The most extensively grown special crop in southern New Jersey is the Irish potato. For the production of this crop 60 per cent of the correspondents preferred a loam soil and 6 per cent desired a "clay," probably referring to the Sassafras loam. It may, therefore, be said with confidence that two-thirds of the 450 expressed preferences indicate that a loam or heavy loam soil is best for potato growing in southern New Jersey. The remainder of the answers expressed a preference for a sandy loam soil.

These facts correspond very closely with the recorded facts of the crop and soil surveys of the four selected areas. Those surveys disclosed that the greater acreage of potatoes was grown on the Sassafras loam and that the Sassafras sandy loam and Collington fine sand loam were also extensively used for the crop. General observation also shows that the Collington sandy loam should be included in the group of preferred potato soil.

Only one crop is selected for production upon soils heavier in texture than those required for potato growing. The cabbage crop is to be grown either upon a loam or a heavy loam soil, if the preferences of 187 southern New Jersey farmers are followed. This accords well with the facts as observed. The Sassafras loam is used to some extent for growing cabbage. The soils of the Shrewsbury and Keansburg series are also occupied by considerable acreages of cabbage. There is a general tendency in the intensive trucking districts to plant cabbage upon the heaviest and most retentive soils

present or to place the crop where small depressions accumulate seepage waters from higher lying areas of sandy loam. Unless the land is actually flooded, the cabbage crop makes good growth upon these moist lands.

COMPARISON OF EXPRESSED PREFERENCE WITH RESULTS OF DETAILED SURVEYS.

A general comparison may be made between the facts as observed in the four detailed areas where distinct soil types and their crop areas were mapped and the preferences as expressed by southern New Jersey farmers as summarized and tabulated. The two sets of results are presented in detail in Tables XI, XII, and XIII.

Irish potatoes.—The crop maps show that 36.3 per cent of the Sassafras loam is occupied by Irish potatoes and that this is the only important truck crop grown on the type. The replies to inquiries show that 66 per cent of the farmers prefer a loam or heavy loam soil for the crop, while 34 per cent wish a sandy loam. The Sassafras sandy loam carried the only other important acreage in potatoes in the mapped area.

Sweet potatoes.—The largest acreages of this crop were mapped on the Sassafras coarse sandy loam, the Sassafras sandy loam, and the Sassafras sand. The sand and coarse sandy loam group of soils carried 509.2 acres of sweet potatoes out of a total of 720.1 acres mapped on the dominant soils. The Sassafras sandy loam carried 163.4 acres of the remainder. The expressed soil preferences show sand preferred by 61 per cent of sweet-potato growers and sandy loam by 39 per cent. The facts from the two sources are well in accord.

Tomatoes.—In the case of this crop the two sets of facts appear to be at some variance. It is held, however, that a fifth survey, made in the vicinity of Salem, N. J., would have corrected this seeming discrepancy, since the Sassafras loam is extensively used in that vicinity for the production of canning tomatoes. The Freehold area produced no tomatoes. The Hartford area included areas grown both for market and for canning. The Thorofare and Swedesboro areas included areas of tomatoes grown almost exclusively for market, and only the residue of the crop after the early tomatoes have been shipped is normally sold for canning. Thus the figures from the four detailed areas throw truck crop tomatoes into undue prominence.

It appears from the tabulated areas that slightly more than one-half of all the area in tomatoes was found on the sand and coarse sandy loam soils. Outside of this group, the Sassafras sandy loam was the only type carrying an important acreage, 171 acres in all.

In the tabulated answers to inquiries, 52 per cent of the replies ex-

pressed a preference for a sandy or sandy loam soil for tomato growing, while 48 per cent of the replies indicated a preference for a loam or heavy loam soil. It has already been shown that the latter group corresponds to the canning-crop requirements, while the former indicates the growing of tomatoes as a truck crop.

Sweet corn.—This crop was not mapped separately from field corn in any of the four detailed surveys.

Asparagus.—The mapped areas showed that 349.6 acres of asparagus were grown on the sandy and coarse sandy loam soils. This constitutes 85 per cent of the total acreage mapped. The Sassafras sandy loam carried one-half of the remainder of the total acreage. The answers to inquiries indicate 26 per cent of the farmers distinctly preferring a sand soil and 61 per cent desiring a sandy loam soil for this crop. It may thus be said that the more sandy soils are best for asparagus growing. The existence of a sandy loam deep subsoil was especially required in many of the answers.

Cantaloupes.—The mapped areas of this crop showed 140.6 acres grown on the soils of the sand and coarse sandy loam group. The answers to inquiries indicate a preference for sandy soils to the extent of 25 per cent of the total and for sandy loam soils to the extent of 63 per cent. Loam soils were preferred in 12 per cent of the answers. It will be noted that the Sassafras sand carried 93.1 acres out of a total of 165.3 acres of the crop as mapped. The Sassafras coarse sandy loam and sandy loam carried the other important acreages.

Cabbage.—The Sassafras loam bore 31.1 acres of cabbage out of 42.5 acres mapped. The Portsmouth sandy loam carried 9.5 acres of the remainder. In the answers to inquiries, 71 per cent of the growers preferred a loam, while 11 per cent desired an even heavier soil. The Portsmouth sandy loam, because of imperfect drainage, responds to cropping in a manner similar to an ordinary loam. The agreement of mapped facts and those derived from correspondence is close.

Watermelons.—Within the mapped areas watermelons occurred to the extent of 24.7 acres on the Sassafras sand, out of a total of 47.5 acres mapped. Eighty per cent of the crop was found on the sand and coarse sandy loam group. In the replies to inquiries it was found that 56 per cent of the replies favored a sand soil and 41 per cent a sandy loam.

None of the other minor truck crops were encountered in sufficient area to permit of any very definite conclusions.

Allowing for slight differences in the usage of soil nomenclature as between the popular custom and the professional classification, the correspondence between the two classes of evidence is seen to be striking.

SOIL AND CROP GEOGRAPHY.

The result of all of the facts thus ascertained concerning the distribution of the different soils in southern New Jersey is plotted on the map. (Plate A, page 16.)

The salient facts with respect to crop distribution are similarly presented in the form of the map. (Plate B, page 64.)

These two maps exhibit in a graphic way the broader facts of the uses of specific soils and groups of soils for the production of distinct crops and associations of crops.

The striking features of correspondence between the two maps are:

The sandy soils of the Lakewood series have been found to be too droughty for the common practices of crop production, and the greater part of their area remains in forest.

The undrained soils of the tide-marsh areas have been reclaimed only to a small extent, and they are chiefly unused or only occupied for the growing of forage crops or for pasturage.

The soils derived from the outcroppings of the marly deposits of Cretaceous and Eocene age are chiefly occupied for general farming purposes and to a limited degree for the growing of special crops. Only steep topography and excessive erosion interfere with complete occupation of the soils of the Collington and Colts Neck series, which are the chief soils derived from these deposits.

The soils derived from the later sediments which mantle a large area within the Raritan and Delaware Valleys and which occur as a terraced border around a large part of southern New Jersey are occupied almost to the limits of their occurrence for the growing of a wide variety of crops. The soils of this origin belong chiefly to the Sassafras series. Within this series the selection of particular soils for specific crop uses has proceeded further and has reached a greater degree of specialization than on any other group in the region.

In a general way the distribution of soil series and types in southern New Jersey is marked by zonal alignment and the distribution of dominant groups of crops follows that form.

Neither climatic differences, which are small, nor differences in distance to market, which are relatively slight but which occur, nor differences in local transportation facilities, which exist to a limited degree—*no one, nor all of these influences, has been sufficient to obscure the evident dependence of crop production upon the geographical distribution of soils suited to the growing of certain crops and unsuited to the growing of others.*

REVIEW OF SOIL USES BY SERIES, CLASSES, AND TYPES.

For the purposes of the production of the general farm crops—hay, corn, wheat, oats, and grass for pasture—the heavier loam soils

are preferred. Their presence in dominant area invariably leads to the production of these crops in chief acreage. As a result, dairying, the sale of wheat, corn, and hay as cash crops, and the growing of one other sale crop, Irish potatoes, constitute the dependence of those farmers whose holdings include any large areas of the Sassafras loam, Sassafras fine sandy loam, Collington fine sandy loam, and Collington sandy loam.

For the growing of potatoes the heavier soils of the Sassafras and Collington series are especially well suited. Consequently, Irish potatoes are the most extensively grown sale crop within the general farming belt, and their extensive production stops sharply at the boundaries of definitely sandy soils. Only for early truck sales are such soils even as the Sassafras sandy loam used to any extent for potato production.

The other main group of soils, the sands and coarse sandy loams, is as distinctly avoided for general farming as the loamy soils are chosen. Wherever the more sandy but tillable soils are found, from Raritan Bay to the mouth of the Delaware, trucking as a distinct farm business has gained the preponderance. Within this group of soils specialization in cropping has gone to such an extent that the farmers of southern New Jersey have developed distinct preferences for definite soil types for the growing of specific crops. The following tabulation, derived chiefly from the results of the detailed soil surveys, will show what experience to the present time has proved to be the accepted crop adaptations of the more extensive trucking soils.

TABLE XIV.—*List of soils by series, groups, and types, showing uses.*

SASSAFRAS SERIES.

Soil group and type.	Truck crops.	General farm crops.	Fruit crops.
I. Sand group:			
Sassafras coarse sand.	Sweet potatoes, asparagus		
Sassafras sand	*Sweet potatoes, asparagus, cantaloupes, tomatoes,*[1] melons, peppers, eggplant, peas, beans, cucumbers, sweet corn.	Corn, *alfalfa, rye*	*Peaches,* berries.
Sassafras loamy sand	*Sweet potatoes, asparagus, cantaloupes, tomatoes,*[1] *melons,* peppers, eggplant, peas, beans, sweet corn.	Corn, *alfalfa, rye, cowpeas.*	*Peaches,* pears, berries.
Sassafras fine sand	Sweet potatoes, asparagus, *tomatoes,*[1] *cantaloupes,* melons, peppers, cucumbers.	Corn, hay, rye	Do.
II. Sandy loam group:			
Sassafras coarse sandy loam.	*Sweet potatoes, tomatoes,*[1] peppers, cucumbers.	*Corn,* hay, *rye, alfalfa*	*Peaches, berries, grapes.*
Sassafras gravelly sandy loam.	*Potatoes, tomatoes,* cabbage, peppers.	*Corn,* hay, *rye,* wheat	*Peaches, pears, apples, cherries, grapes, berries.*
Sassafras sandy loam.	*Potatoes, tomatoes, cabbage, sweet corn, peas, beans.*	*Corn, hay, rye, wheat,* peas, oats, alfalfa.	Apples, pears, peaches, grapes.
III. Loam group:			
Sassafras fine sandy loam.	*Potatoes,* tomatoes for canning, *cabbage.*	*Corn, hay,* wheat, oats	Apples, pears.
Sassafras loam	*Potatoes,* tomatoes for canning, cabbage.	do	Apples.

[1] Early truck crops.

TABLE XIV.—*List of soils by series, groups, and types, showing uses*—Continued.

COLLINGTON SERIES.

Soil group and type.	Truck crops.	General farm crops.	Fruit crops.
Collington sand	*Asparagus*, sweet potatoes, tomatoes,[1] *cantaloupes*, melons.		
Collington loamy sand	*Asparagus*, *melons*, cantaloupes, tomatoes,[1] peppers, sweet potatoes.		
Collington sandy loam, deep phase.	*Asparagus*, *sweet potatoes*, *tomatoes*, cantaloupes, melons, eggplant.	Corn, rye, hay	
Collington sandy loam	*Potatoes*, *tomatoes*, peas, beans.	*Corn*, *hay*, *wheat*	*Peaches*, apples.
Collington fine sandy loam.	*Potatoes*, *tomatoes*, *cabbage*, sweet corn, peppers, asparagus.	*Corn*, *hay*, wheat	*Peaches*, *apples*, *pears*.
Collington loam	*Potatoes*, tomatoes	*Corn*, *hay*, *wheat*, alfalfa.	
Collington gravelly loam		*Pasture*	
Collington clay		Pasture, hay	

COLTS NECK SERIES.

Colts Neck gravelly sand			Peaches.
Colts Neck loamy sand	*Asparagus*, *sweet potatoes*, *cantaloupes*, *melons*, *tomatoes*,[1] sweet corn.	Corn, *rye*	Do.
Colts Neck sandy loam	*Potatoes*, *tomatoes*,[1] asparagus, melons, *sweet corn*.	*Corn*, *hay*, wheat	*Peaches*, apples.
Colts Neck fine sandy loam.	*Potatoes*, tomatoes	do	Peaches, *apples*.
Colts Neck loam	*Potatoes*	*Corn*, *hay*, *wheat*.	Do.

KEYPORT SERIES.

Keyport sandy loam	Peppers, tomatoes,[1] melons		Berries.
Keyport fine sandy loam.	Tomatoes,[1] peppers, cucumbers, melons.		Do.
Keyport loam	Peppers, tomatoes [1]	*Corn*, *hay*	
Keyport clay loam	do	Corn, *hay*	

SHREWSBURY SERIES.

Shrewsbury sandy loam	*Potatoes*, *tomatoes*, peppers	*Corn*, *hay*, wheat	Berries.
Shrewsbury fine sandy loam.	*Potatoes*	*Corn*, hay	Apples, peaches.
Shrewsbury loam		*Corn*, *hay*	
Shrewsbury silt loam		*Hay*	

KEANSBURG SERIES.

Keansburg sand	Tomatoes [1]	Corn	
Keansburg sandy loam.	Potatoes, tomatoes	*Corn*, hay	
Keansburg fine sandy loam.		*Hay*, *pasture*	
Keansburg loam	Potatoes, tomatoes	*Corn*, *hay*	

MISCELLANEOUS SOILS.

Portsmouth sandy loam	*Peppers*, onions, *cabbage*	Corn, hay	Berries.
Hyde loamy sand			*Cranberries*.
Elkton loam	Potatoes, *cabbage*	*Hay*	
Freneau loam	Potatoes	Hay	
Lakewood sand	Asparagus		Dewberries.
Lakewood gravelly sandy loam.	Tomatoes, peppers, sweet corn, potatoes.	Corn, hay	
Lakewood fine sand	Asparagus, cantaloupes, melons, peas, beans, cucumbers, tomatoes, peppers, eggplant, squash.		
Tidal marsh	Cabbage, onions	*Corn*, *hay*	

[1] Early truck crops.

NOTE.—Crops most extensively grown on each type are in italics.

Summarized on the basis of the texture of soils—that is, by classes of soils without reference to the soil series—the soil uses actually found in southern New Jersey are now presented:

Coarse sandy types.—Asparagus and sweet potatoes are the only crops grown in any large area.

Gravelly sand.—Forested or used to a limited extent for peaches.

Sand.—The most important early truck crop class. Preferred for asparagus, sweet potatoes, cantaloupes, early tomatoes, watermelons, peppers, eggplant, peas, and beans. Some sweet corn grown.

Loamy sand.—An early truck soil. Used for sweet potatoes, asparagus, cantaloupes, early tomatoes, peppers, peas, beans, and eggplant. Also for corn, rye, alfalfa, mixed hay, and peach orchards.

Fine sand.—A slightly later truck soil. Tomatoes, peppers, cantaloupes, cucumbers, some sweet potatoes, and asparagus. Corn, rye, and hay, peaches, bramble berries are grown.

All of these classes of soils have a far greater value for the production of early truck crops than for any other purpose, provided markets are available. In the latitude of New Jersey they mature crops at a time when other areas offer little competition. More loamy soils mature crops at a later date and sometimes suffer from severe competition with near-by localities slightly farther south.

Coarse sandy loam.—Nearly as early as the sandy types. Sweet potatoes, asparagus, early tomatoes, peppers, cucumbers predominate. Fairly good crops of mixed hay, good crops of corn, and alfalfa are produced. Peaches, bramble berries, grapes are raised.

Gravelly sandy loam.—When not indurated in the subsoil, produces tomatoes, peppers, early Irish potatoes, early cabbage, corn, hay, and some wheat. Extensively used for peach, apple, pear, and cherry orchards and for plantations of berries and grapes.

Sandy loam.—Possesses the widest range of crop adaptations of any group, being fairly well suited to growing numerous truck crops and nearly all of the general farm crops. Potatoes, tomatoes, peppers, eggplant, cabbage, sweet corn, peas, beans, and even asparagus and watermelons are grown. It is an excellent corn and hay group. Alfalfa beginning to be grown. Fair crops of wheat and rye, and some oats are raised. Good fruit soil when well drained. Apples, pears, peaches, and berries thrive.

This group forms an intermediate set of soils which produces large yields of truck crops at a season usually slightly later than the sand group. The more retentive subsoils permit the growing of the general farm crops which require a longer growing season. The corn and alfalfa crops are particularly successful on soils of this group.

Fine sandy loam.—This class of soils falls naturally with the more loamy and later maturing soil types. Potatoes, tomatoes for canning, cabbage, and sweet corn are important special crops. The types

produce good crops of corn, mixed hay, rye, wheat, oats, and cowpeas. Apples and pears do well.

Loam.—This class includes the best general farming soils in southern New Jersey. Potatoes are the chief cash crop, with tomatoes for canning becoming an important crop in some sections. Corn, mixed hay, wheat, and oats produce their largest yields upon soils of this group, particularly upon the Sassafras loam, which is of greater extent and importance than any other single soil in the region. Apples, pears, and cherries thrive at proper elevations.

The fine sandy loam and loam soils rank together in their crop adaptations in this general region. They form the basis for the production of the general farm crops, for dairying, for the most extensive production of potatoes, and of tomatoes for canning. They produce the larger part of the forage crops and a considerable preponderance of the potato crop in the southern part of the State.

Corn, wheat, hay, potatoes, and dairy products are the chief commodities sold from them.

Silt loam.—Represented by only one type of limited extent. On this, hay and pasture are the chief form of agricultural production. Cabbage and potatoes are grown to a limited extent.

Clay.—Sparingly represented in southern New Jersey and usually avoided for crop production. Hay and pasture are the chief uses.

Tidal marsh.—Of considerable extent but sparingly utilized. Chiefly in grass for pasturage or hay. Some small areas are tilled to corn. Limited areas are devoted to tomatoes and cabbage.

CONCLUSION.

(1) The geographic location of the southern New Jersey region is such that the largest markets for staple and special farm products on the continent lie within easy reach of even the most remote localities. (See fig. 2, p. 4.)

(2) Transportation by steam railroad, by electric railroad, by improved highways, and even by water routes is more completely established than in the majority of communities in the country. (See fig. 2.)

(3) Agriculture has been established for a period of 275 years in parts of the territory under discussion. It has been established over the arable soils of practically all of southern New Jersey for a period in excess of 200 years.

(4) The region has sufficient rainfall during the year and during the growing season for maturing all the most important staple and special crops suited to the latitude. The growing season between killing frosts is usually six months long. (See fig. 1, p. 3.)

(5) There are within the region no differences in elevation which seriously disturb the climatic conditions imposed by latitude. The presence of large bodies of water exerts an equalizing influence upon temperatures which is sensibly evident to a distance of 10 or 15 miles from the Atlantic coast and to a distance of 5 to 10 miles from Delaware River and Bay. (See fig. 3, p. 6.)

(6) The more than two centuries of agricultural development in the region have brought about a thorough comprehension of the fact that crops do not all thrive equally well upon all soils. There has been a constant tendency to adapt the cropping and the agricultural systems of the regions to local soil conditions in such a way that the most paying crops may be grown upon each soil of marked characteristics. (See pl. A, p. 16, and pl. 13, p. 64.)

(7) This selective cropping has resulted in:

(*a*) The avoidance of excessively drained soils, like those of the Lakewood series, for any agricultural use.

(*b*) A failure to utilize wet soils for any but the most extensive systems of cropping, such as the growing of grass for pasture and hay upon the Tidal marsh areas.

(*c*) The utilization of the more sandy soils, irrespective of their relative distance from market, for the growing of the early vegetables, commonly called truck crops.

(*d*) The use of intermediate types of soils, such as the sandy loams, for the growing of a wide variety of truck crops, general farm crops and, where altitude favors, of commercial orchard crops.

(*e*) A decided specialization toward the grain and grass crops upon the fine sandy loam and loam soils, with the more recent use of the loam soils for the growing of Irish potatoes and of tomatoes for canning purposes.

(*f*) The utilization of every reasonably level acre of good upland soil for crop production of some kind. (See detailed soil and crop maps.)

(*g*) The utilization of small areas of overflow or of undrained land for grazing purposes in connection with the special tillage of all upland areas.

(9) Other things being reasonably equal, the farmers of southern New Jersey have a very decided and well founded preference for the utilization of each specific soil type for the growing of the special crop or group of crops which is best suited to that soil. (See Table XIII, p. 66, and detailed soil and crop maps.)

(10). These crop uses are given in some detail for the most important soil types and soil classes which have been encountered in four detailed surveys made in southern New Jersey. The uses of

certain of the soils are established by four detailed maps showing the soil types and the crops actually supported by them. These four soil and crop maps represent four distinct sets of soil conditions and of resultant crop production. They fairly represent the range of soil and crop conditions within the area.

(11) The conditions, as depicted by the several classes of maps, agree within reasonable limits with the opinions of nearly 1,000 farmers in the region who expressed their soil preference for specific crops. (See detailed soil and crop maps and Table XIII.)

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SOIL AND CROP MAP

NEW JERSEY
FREEHOLD SHEET

FREEHOLD

LEGEND

- Sassafras loam — 2
- Sassafras sandy loam — 6
- Colts Neck loam — 9
- Colts Neck sandy loam — 10
- Collington loam — 10
- Collington clay loam — 12
- Collington sandy loam — 11
- Freehold loam — 62
- Woodland — [illegible]
- Drainage — [illegible]

Surveyed by J. A. Bonsteel of the U. S. Department of Agriculture

Scale in feet

1000 500 0 1000 2000 3000

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ord

2000

SOIL AND CROP MAP

LEGEND

Sassafras loam — 2

Sassafras sandy loam — 6

Colluvium on Sassafras — 57

Colluvium on Sassafras sandy loam — 14

Collington sandy loam — 11

Bertie loam — 32

Made ground — 98

Portsmouth sandy loam — 4

Alluvium — 37

Dumps and fills — 93

Swamp

Wooded area

Interplanting

Excavations

Surveyed by J. A. Bonsteel of the U. S. Department of Agriculture

Scale in feet

-1000 -500 0 1000 2000

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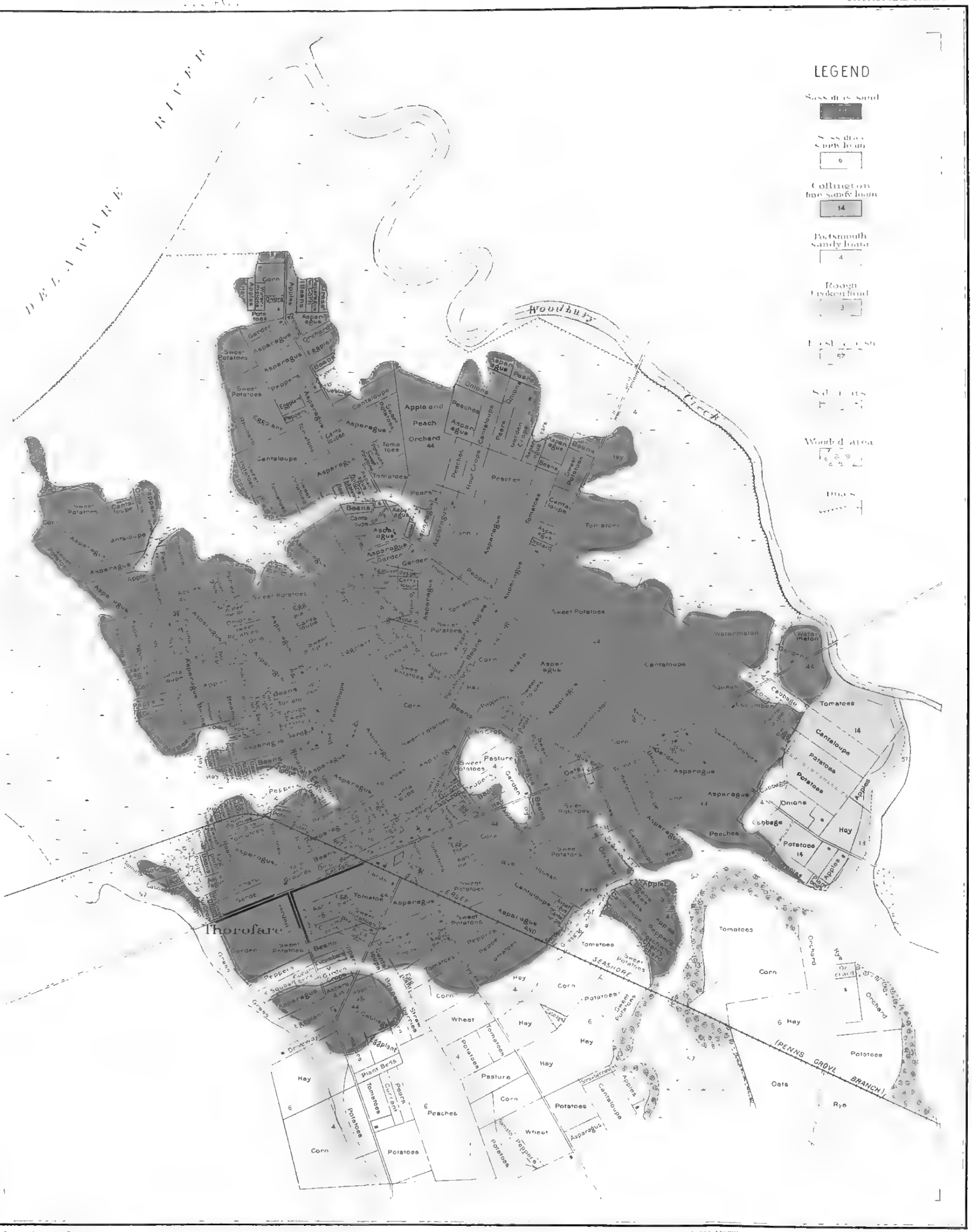
SOIL AND CROP MAP

NEW JERSEY
THOROFARE SHEET



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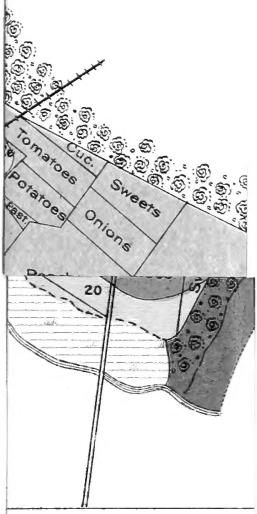

3000

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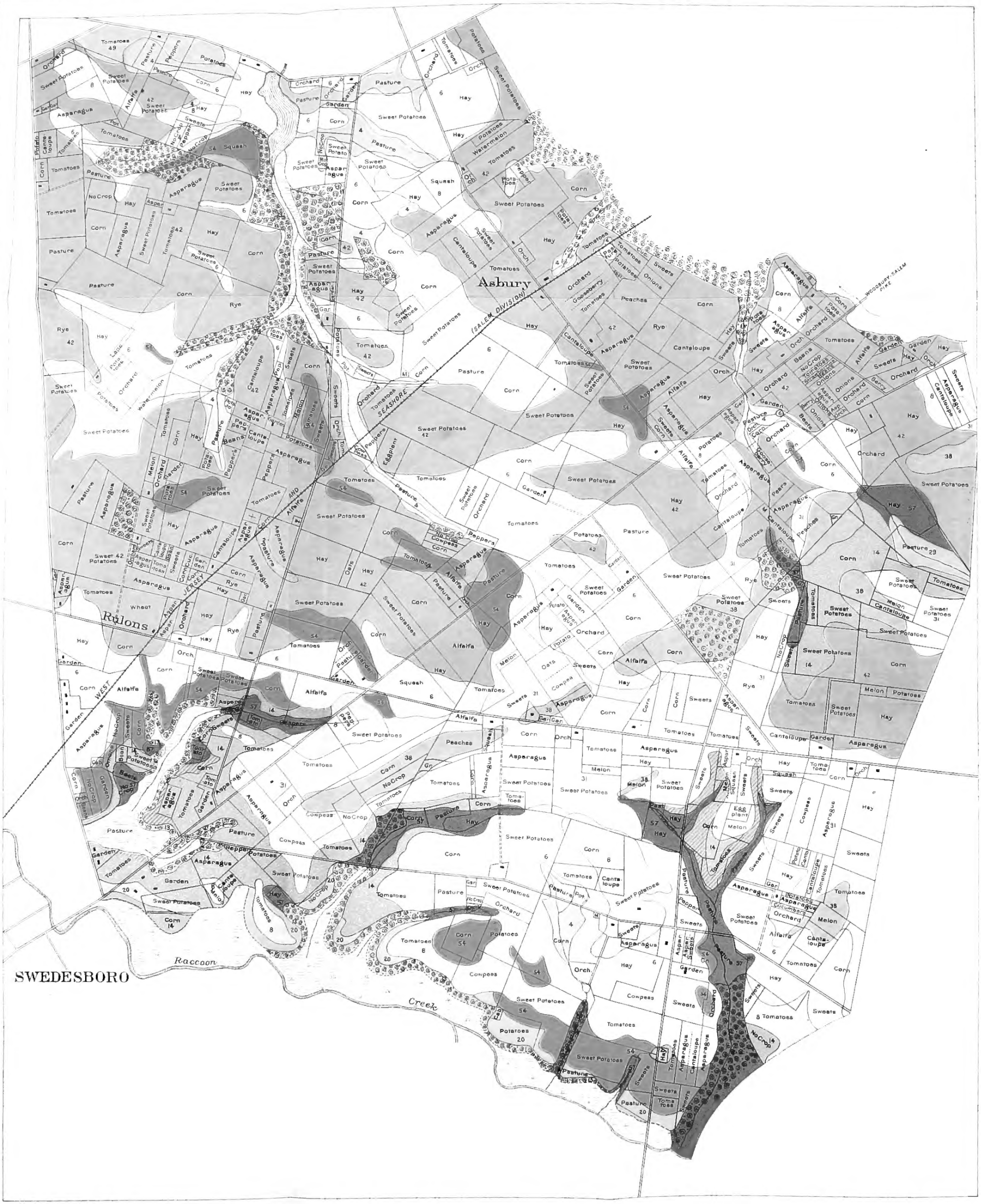
SOIL AND CROP MAP

NEW JERSEY
SWEDESBORO SHEET



LEGEND

- Sassafras coarse sand — 8
- Sassafras gravelly coarse sandy loam — 54
- Sassafras coarse sandy loam — 42
- Sassafras sandy loam — 6
- Sassafras fine sandy loam — 49
- Sassafras loam — 2
- Colts Neck gravelly sandy loam — 38
- Colts Neck loamy sand — 31
- Collington gravelly sandy loam — 20
- Collington fine sandy loam — 14
- 14 — Eroded phase
- Portsmouth sandy loam — 4
- Hyde sandy loam — 29
- Freneau loam — 57
- Rough broken land — 13
- Fresh marsh
- Salt marsh
- Wooded area
- Interplanting — Orchard Tomatoes
- Melons — M
- Garden — G
- Gravel pit — Gr
- Sweet Potatoes — Sweets

Surveyed by J. A. Bonsteel of the U. S. Department of Agriculture.

Scale in feet
1000 500 0 1000 2000 3000

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